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A RAND NOTE

Aerospace Weapon System Acquisition Milestones: A Data Base

M. B. Rothman

October 1987

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Critics of the weapons acquisition process have often asserted that it takes too long to achieve new operational capabilities. These declarations are seldom accompanied by quantitative evidence. This study is designed to add to the limited body of literature documenting major milestones in the acquisition history of weapon systems. It presents chronologies drawn from the unclassified literature and supplemented by data collected through direct contacts with project personnel. The data cover 50 aircraft, 24 helicopters, and 53 missiles developed since the mid-1940s. A limited analysis tenuously supports the idea that the period from the beginning of the demonstration-and-validation phase to the start of full-scale development has been lengthening over the past three decades. However, calendar date alone explains little of the program-to-program variance.

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Prepared for
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for Acquisition

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PREFACE

A continuing theme voiced by critics of the weapons acquisition process is that it takes too long to achieve a new operational capability, and, furthermore, that it now takes longer than it used to. They fear that a sluggish acquisition system will prevent the United States military from effectively capitalizing on new technologies and responding to new threats. There is also good evidence that long, drawn-out development and production periods drive up system cost. Such criticisms are, however, rarely accompanied by persuasive data concerning the length of the acquisition cycle.

A few studies have been published that provide some quantitative information on the schedules of past weapon acquisition programs, including an earlier report by RAND.[1] This Note provides an updated and expanded version of the data base on program schedule milestones that appeared in the earlier report. Although the analysis and interpretation of these data are the subject of continuing research, the data base is being published separately so that it can be available to others conducting research on this topic.

This study was sponsored by the Office of the Under Secretary of Defense for Acquisition and was carried out in the Applied Science and Technology Program of the National Defense Research Institute, RAND's OSD-supported Federally Funded Research and Development Center.

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[1]G. K. Smith and E. T. Friedmann, *An Analysis of Weapon System Acquisition Intervals, Past and Present,* The RAND Corporation, R-2605-DR&E/AF, November 1980.

SUMMARY

Critics of the weapons acquisition process have often asserted that it takes too long to achieve new operational capabilities. Declarations of this sort are seldom, however, accompanied by quantitative evidence. This study is intended to increase the limited, but expanding, body of literature documenting major milestones in the acquisition history of weapon systems. Chronologies, drawn from the unclassified literature and supplemented by personal contacts with project personnel, are provided for 50 aircraft, 24 helicopters, and 53 missiles developed since the mid 1940s.

A limited analysis of the data provides some tenuous support for the belief that the time period from the beginning of the demonstration and validation phase (roughly equivalent to Milestone I as defined in DoD Directive 5000.1) to the start of full-scale development has been lengthening over the past three decades. However, calendar date alone explains little of the program-to-program variance. Further analysis, including consideration of other factors, will be necessary to adequately understand such trends and their causes. In addition, a larger weapon system data base should permit stronger conclusions on the regression statistics and more detailed analyses of weapon sub-categories (SAMs, ICBMs, bombers) than are possible at this time. This Note, consisting mainly of the underlying data base, is being published separately so that it can be available to others conducting research on this topic.

ACKNOWLEDGMENTS

Giles Smith was the major partner in this effort: guiding the research, aiding in important methodological decisions, and helping to organize and present the results and findings. Bill Stanley made an excellent technical review of this note that helped us to sharpen our analysis and discussion.

Jean Thomas deserves special thanks for her tireless and thorough effort to organize, edit and format the lengthy appendixes to this publication. To accomplish this task she not only sacrificed many evenings, nights and weekends but patiently overcame numerous computer software and hardware bugs.

Many program offices were responsive to our telephone requests for historical information, but Dr. Raymond Puffer of the AFSC's Ballistic Missile Office (BMO) was especially helpful in providing extensive chronologies on many older ballistic missile systems.

James Quinlivan and Toni Richards helped in choosing appropriate statistical techniques and graphical displays for the analysis of population subgroups.

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I. INTRODUCTION

Critics of the weapons acquisition process often say that it takes too long to achieve new operational capabilities. However, quantitative evidence seldom accompanies declarations of this sort. This study is intended to increase the limited, but expanding, body of literature documenting major milestones in the acquisition history of weapon systems.

Several studies published over the past few years have provided quantitative information on the schedules of earlier weapon acquisition programs. In 1980 RAND published an analysis of acquisition schedule histories for some five dozen aircraft, helicopters, and missiles developed during the previous 35 years.[1] In 1982 the Air Force conducted the Affordable Acquisition Approach (A3) Study, which included an attempt to determine not only the actual schedules of past programs, but also the factors that affect the length of the acquisition cycle.[2] The study group gathered historical data for 83 Air Force weapon systems and chose dates for (a) program start, (b) full-scale development (FSD) start, and (c) first production delivery. The group then analyzed the three development cycle periods by weapon system subgroup. They concluded that the acquisition cycle is lengthening as we move from the post-WW II period to the present day, especially in the case of aircraft and space systems. A third study, conducted in 1986 by the Aeronautical Systems Division (ASD) of the Air Force Systems Command (AFSC), expanded the A3 data base for fighter aircraft by adding several Navy systems.[3] ASD is continuing to document and analyze the schedules of weapon systems.

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[1]G. K. Smith and E. T. Friedmann, *An Analysis of Weapon System Acquisition Intervals, Past and Present*, The RAND Corporation, R-2605-DR&E/AF, November 1980.

[2]Air Force Systems Command, *The Affordable Acquisition Approach Data Handbook*, Vol. I, Andrews Air Force Base, 15 November 1982.

[3]Stellitsa N. Rozakis, *Independent Schedule Assessment Data Base System Narratives for Fighter Aircraft*, prepared for Aeronautical Systems Division (ASD/ACCR) by The Analytic Sciences Corporation, TR-5300-3-3, 17 July 1986.

More recently, the Packard Commission reported that

> ...a much more serious result of this management environment is an unreasonably long acquisition cycle--ten to fifteen years for our major weapon systems. This is a central problem from which most other acquisition problems stem.[4]

The Commission did not, however, provide quantitative analysis or data to support their conclusion.

Given the renewed interest in the length of the acquisition cycle, the continuing paucity of supporting data, and the perceived adverse effects of long acquisition cycles, it seemed worthwhile to update the 1980 RAND publication. In the present Note, we offer a history of major schedule events for three broad categories of aerospace systems procured by the three services since World War II. The structure of the data is described in Sec. II, and the chronologies themselves are found in three Appendixes, covering aircraft, helicopters, and missiles, respectively.

Our principal goal in this Note is to provide a data base, although without much supporting analysis or interpretation (the subject of continuing research). We do provide, in Sec. III, a few graphic displays and statistical analyses of some acquisition intervals to help the reader make a first-order interpretation of the data.

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[4] *A Quest For Excellence: Final Report to the President*, the President's Blue Ribbon Commission on Defense Management, June 1986.

II. DATA DESCRIPTION

The selection of systems for study was guided by availability of information and comparability among the systems in the data base. Warships, space systems, communication systems, and radars were not included because they go through distinctly different acquisition processes that are not readily comparable with airplanes, missiles, and helicopters. Ground combat vehicles were not included because of our limited experience with these systems and because of our limited access to historical data on Army programs. This obstacle also severely hampered our efforts to gather an adequate set of data on Army missile systems. In sum, the set contains the vast majority of airplanes and a solid majority of the missiles and helicopters developed since 1945.

To permit analysis of several acquisition cycle intervals we identified and recorded any major event or milestone in the program history that was available in the unclassified literature. To facilitate consistent comparison of programs conducted during different time periods and under different management systems, we put special emphasis on identifying three milestones for each system:[1]

A. The Defense Systems Acquisition Review Council Milestone I (DSARC I),[2] the start of the demonstration and validation phase or its equivalent for systems started prior to 1969 when the DSARC review process was instituted; this milestone marks the beginning of the period where contractor(s) and System Program Office (SPO) prepare designs and perform hardware testing in preparation for full-scale development;

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[1]Although two of these milestones often coincide with formal review milestones established by the Department of Defense in DoD Directive 5000.1, the third does not. Therefore, we label the milestones in this study A, B, and C (or Program Start, FSD start and First Delivery in the graphs and analysis) to avoid possible confusion with DoD review milestones that are typically defined as I, II, and III.

[2]Although the DSARC system has been transformed under the Defense Department Reorganization Act, we use the old terminology.

B. The beginning of full-scale development, which can occur prior to, concurrent with, or following DSARC II approval; this milestone begins the phase where full-scale hardware is developed, an initial batch of units is fabricated and tested, and production tooling is installed;

C. Delivery of the first operationally configured production article.

Milestone A is the most difficult date to define consistently over time. The current DSARC I, which defines the start of concept validation, comes some time after the official program start (preparation of a mission needs statement that is typically characteristic of DSARC Milestone 0). Historically, the early development stages were not structured in this manner and it is nearly impossible to distinguish these two major milestones in older systems. The structured DSARC review approach to initial development may make the process appear to take longer: early design efforts that were once not assigned to any one program are now recorded as part of an incipient mission which later evolves into a weapon system. As a substitute for DSARC I dates in older systems, we chose the start of design or study efforts connected with a single cohesive weapon system (as opposed to component technologies or concepts which can start considerably earlier). This date may be the organization of a System Program Office, the awarding of design study contracts, or other similar event signifying concerted design studies to satisfy a particular mission capability, but falling short of full-scale development. The date we selected is noted by the symbol "A" in the left margin of each chronology shown in the appendixes. In some of the earlier programs there was not enough information available to select a Milestone A date.

For Milestone B, we use the DSARC II approval date for full-scale development or the FSD contract date, depending on which comes first. Prior to 1969 the development contract date is usually all that is available. For systems starting before 1981, we use the DSARC II meeting date as Milestone B, assuming that FSD tasks begin before the contract is signed. Because it has not been necessary since 1981 to

secure DSARC II approval prior to the start of FSD, the two dates can be very dissimilar (for AMRAAM FSD started nine months after DSARC II). In these cases we use the FSD contract date or an indication that FSD has begun.

Systems that begin with prototypes provide a special coding problem because of the difficulty of distinguishing prototype from production system efforts. We treat the prototype and system development stages as distinct but overlapping efforts. As a rule, system Milestone B must occur after start of prototype development. System Milestone A can be the start of prototype development, but this is not necessarily the case, especially for DSARC systems.

Milestone C is the first production delivery of an operational article. This definition excludes delivery of pre-production or production items intended exclusively for testing. Typically this milestone occurs well before Initial Operational Capability (IOC); however, for missile systems that go through rigorous initial testing and modification we use the IOC date or the first delivery to an operational unit. For many systems, "first production delivery" is the only date available, but for recent systems we can usually distinguish the first operational delivery from test article delivery and "squadron" or "flight" delivery. Pre-production deliveries are used if they are operational articles.

Any broad compilation of system milestones of the sort presented here is inevitably subject to several limitations. In addition to the approximations involved in selecting milestones for older systems, particularly the Milestone A date, each project evolves in its own special context which cannot be adequately described by a simple chronology. We hope to capture some of this complexity in future studies of other factors affecting the acquisition schedule.

We made an effort to find data for as many new systems as possible, but made no effort to collect data on a complete set of system modifications. The modified versions that are included in the appendixes are meant to give a general picture of how some of the original systems were later used and updated. Modification of existing systems is frequently more efficient in bringing new technology into the field, and a full discussion of the pace of weapon system development

must include analysis of modifications. However, differences between systems in the degree of their modification limit the usefulness of simple-minded comparisons. This problem is limited by applying basic analysis techniques to only new system development efforts. Therefore, modification programs are not included in the analysis charts and statistics. Accurate analysis of modified systems, and comparisons between the modification and new program development routes must be left for future work.

A substantial majority of our data is for Air Force systems. This bias in the data is purely a function of our better access to Air Force information sources, but has limited our analysis to aerospace systems. In the future we hope to assemble a more complete set of aerospace systems for all services and to include ground combat vehicles in the analysis.

III. ANALYSIS OF ACQUISITION CYCLE TIME INTERVALS

Use of the three milestone dates allows determination of three "intervals" that characterize the pre-production portion of the acquisition cycle: the validation phase; the development phase; and the sum of the two, comprising the major part of the pre-production acquisition cycle. By examining these three intervals for systems developed over a period of several decades, we can try to obtain a first-order answer to two questions: have acquisition times been getting longer, and if so, in which phases of the acquisition cycle?

Table 1 shows the systems for which we have gathered adequate data to determine at least one interval (intervals are in months). The table shows the lead service, the system type (aircraft, missile, or helicopter),[1] three milestones, and the consequent development intervals. Systems that are included in the regression analyses are marked with an asterisk. The additional systems included in the distribution analyses are marked with a plus. Only the 16 modified systems and the two aircraft starting during World War II are excluded from the distribution analyses. Table 2 shows a breakdown of which subcategories of systems are used in the regression and distribution analyses.

Helicopters were a special problem because of relatively poor documentation and because their acquisition methods frequently differ from the other systems. Because the military frequently buys helicopter airframes "off the shelf," it was usually impossible to assign a Milestone A date. It was also difficult to make a good Milestone B choice. As a result, many more helicopter systems are discussed in the chronologies and shown in the frequency graphs than are shown in the distribution analyses.

Figures 1, 2, and 3 show the data distributions for the total development period, program start to first delivery, and for the two

[1]Adding an "M" to a system type "AM", "MM" or "HM" indicates a modification of an existing design.

Table 1

SYSTEMS THAT PERMIT MEASUREMENT OF AT LEAST ONE ACQUISITION INTERVAL

	System[a]	Service	Type[b]	Milestone A	Milestone B	Milestone C	Interval 1	Interval 2	Total
+	A-4	N	A		6/52	8/55		38	
+	A-5	N	A		6/56	2/60		44	
*	A-6	N	A	5/57	12/57	2/63	7	62	69
*	A-7	N	A	12/62	3/64	3/66	15	24	39
	A-7D	AF	AM		10/66	9/69		35	
*	A-10	AF	A	4/70	1/73	11/75	33	34	67
*	AV-8B	N	A	3/76	4/79	9/83	37	53	90
+	B-1A	AF	A	4/64	6/70		74		
+	B-1B	AF	A		1/82	6/85		41	
	B-47	AF	A	10/43	9/48	12/50	59	27	86
*	B-52	AF	A	4/45	2/51	11/55	70	57	127
*	B-58	AF	A	3/49	2/53	11/59	47	81	128
	B-66	AF	AM		2/52	1/55		35	
+	B-70	AF	A	11/55	12/57		25		
*	C-5A	AF	A	3/64	10/65	12/69	19	50	69
+	C-5B	AF	A		10/82	7/86		45	
+	C-17A	AF	A	8/81	1/85		41		
*	C-130	AF	A	1/51	9/52	12/55	20	39	59
+	C-133	AF	A		11/52	8/57		57	
*	C-141	AF	A	5/60	4/61	10/64	11	42	53
+	F3D	N	A		6/48	8/50		26	
*	F-4 (F4H)	N	A	10/54	5/55	12/60	7	67	74
*	F-14	N	A	11/67	2/69	5/72	15	39	54
*	F-15	AF	A	4/65	1/70	11/74	57	58	115
*	F-16	AF	A	9/71	1/75	8/78	40	43	83
*	F-18	N	A	9/71	12/75	5/80	51	53	104
	F-84	AF	A	10/44	1/45	6/47	3	29	32
*	F-86	AF	A	5/45	12/46	5/48	19	17	36
*	F-89	AF	A	8/45	10/48	9/50	38	23	61
+	F-94	AF	A		10/48	12/49		14	
*	F-100	AF	A	1/51	2/52	10/53	13	20	33
*	F-101	AF	A	1/51	10/51	5/57	9	67	76
*	F-102	AF	A	1/49	9/51	6/55	32	45	77
*	F-104	AF	A	12/52	7/54	1/58	19	42	61
*	F-105	AF	A	3/52	9/52	5/58	6	68	74

Table 1 (continued)

	System[a]	Service	Type[b]	Milestone A	Milestone B	Milestone C	Interval 1	Interval 2	Total
+	F-106	AF	A		11/55	5/59		42	
*	F-111	AF	A	2/60	12/62	4/67	34	52	86
*	KC-10A	AF	A	1/75	12/77	3/81	35	39	74
+	KC-135	AF	A		8/54	1/57		29	
+	P-3	N	A		4/58	3/62		47	
	P-3C	N	AM	9/65	9/67	2/69	24	20	44
*	S-3A	N	A	11/65	8/69	10/73	45	50	95
*	T-39A	AF	A	3/56	10/58	6/61	31	32	63
+	T-45A	N	A		11/81	5/86		54	
+	T-46	AF	A	3/78	7/82		52		
+	V-22	N	A	11/82	4/86		41		
+	AH-1G	A	H		4/66	6/67		14	
*	AH-64	A	H	9/72	12/76	1/85	51	97	148
	AHIP	A	HM		9/81	12/85		51	
+	CH-46	A	H		7/58	5/62		46	
	CH-47D	A	HM		10/75	5/82		79	
+	CH-53A	N	H		8/62	9/66		49	
+	OH-6	A	H		5/65	9/66		16	
+	SH-3	N	H		9/57	9/61		48	
*	SH-60B	N	H	4/70	2/78	3/83	94	61	155
	UH-1D	A	HM		7/60	5/63		34	
	UH-1E	MC	HM		3/62	2/64		23	
	UH-1F	AF	HM		6/63	9/64		15	
	UH-1N	AF,N,MC	HM		5/68	6/70		25	
+	UH-43	N	H		6/50	4/58		94	
*	UH-60	A	H	5/71	8/72	10/78	15	74	89
+	Condor	N	M	6/66	8/73		86		
*	Maverick	AF	M	6/66	7/68	12/72	25	53	78
	IIR Maverick	AF	MM	11/73	10/78	10/83	59	60	119
*	SRAM	AF	M	4/63	10/66	3/72	42	65	107
*	Harpoon	N	M	11/70	6/73	2/77	31	44	75
*	ALCM	AF	M	2/74	1/77	4/81	35	51	86
*	HARM	AF	M	6/72	2/78	12/82	68	58	126
*	Hellfire	A	M	12/72	2/76	7/83	38	89	127
	7F Sparrow III	AF,N	MM	7/66	2/73	1/76	79	35	114
	7M Sparrow III	AF,N	MM	10/74	4/78		42		
*	9A Sidewinder	N	M	6/49	12/51	1/56	30	49	79
	9L Sidewinder	N	MM	10/70	8/71		10		
+	Phoenix	N	M		12/62	3/73		123	

Table 1 (continued)

	System[a]	Service	Type[b]	Milestone A	Milestone B	Milestone C	Interval 1	Interval 2	Total
	I-Phoenix	N	MM	10/76	2/78	10/82	16	56	72
+	AMRAAM	AF	M	11/78	12/81		37		
+	Sea Lance	N	M	4/81	6/86		62		
+	ATACMS	A	M	7/83	3/86		32		
*	Atlas	AF	M	1/51	12/57	10/59	83	22	105
*	TOW	A	M	10/62	11/65	9/70	37	58	95
	TOW II	A	MM		8/79	9/83		49	
+	GLCM	AF	M		1/77	8/82		67	
*	SLCM	N	M	2/74	1/77	7/82	35	66	101
*	Stinger	A	M	10/67	6/72	9/80	56	99	155
*	Quail	AF	M	10/53	2/56	9/60	28	55	83
+	Hound Dog	AF	M		8/57	12/59		28	
+	Skybolt	AF	M	7/57	2/60		31		
*	Falcon	AF	M	3/47	3/48	11/54	12	80	92
*	Bomarc	AF	M	1/50	1/51	4/59	12	99	111
	I-Hawk	A	MM		11/64	11/72		96	
*	Patriot	A	M	5/67	2/72	2/82	57	120	177
*	Minuteman I	AF	M	12/56	10/58	10/62	22	48	70
	Minuteman II	AF	MM	12/65	4/66	6/70	4	50	54
*	Peacekeeper	AF	M	3/76	6/79	8/86	39	86	125
*	Pershing II	A	M	1/74	12/78	10/82	59	46	105
+	RAM	N	M	2/77	6/79		28		
+	Navaho	AF	M	4/46	3/52		71		
+	Thor	AF	M		12/55	5/58		29	
*	Titan I	AF	M	5/55	10/55	8/60	5	58	63
+	SICBM	AF	M	12/83	12/86		36		
	Titan II	AF	MM	9/59	5/60	12/62	8	31	39
*	Matador	AF	M	8/45	6/47	6/52	22	60	82
*	Mace	AF	M	10/54	1/56	11/60	15	58	73
*	A-1 Polaris	N	M	12/56		11/60			47
*	C-3 Poseidon	N	M	11/63	1/65	3/71	14	75	89
*	C-4 Trident I	N	M	10/71	10/73	10/79	24	72	96
+	D-4 Trident II	N	M	10/80	9/83		35		

[a] * = included in regression analyses.
+ = included in distribution analyses.

[b] A = aircraft, M = missile. An additional M means the aircraft or missile was modified.

Table 2

BREAKDOWN OF WEAPON SYSTEM MILESTONE DATA

Systems in regression analysis (full data):			**52**
24 missiles[a]	23 pre 1960 start[a]	7 Army	
25 aircraft	29 post 1960 start	31 Air Force	
3 helicopters		14 Navy[a]	
Additional systems in distribution charts (partial data):			
Program start to FSD (6 cancelled, 8 in progress):			**14**
9 missiles	3 pre 1960 start	1 Army	
5 aircraft	11 post 1960 start	8 Air Force	
		5 Navy	
FSD to First Delivery:			**21**
4 missiles	13 pre 1960 start	3 Army	
11 aircraft	8 post 1960 start	9 Air Force	
6 helicopters		9 Navy	
Modified systems (not included):			**18**
7 with full data			
9 with FSD-delivery data			
2 with start-FSD data			
Of the 7 with full data:			
6 missiles			
1 aircraft			
Systems beginning before end of WW II (not included):			**2**
2 Air Force aircraft			
Systems with data for at least one time period:			**107**

[a]Includes Polaris which has data only for Program Start to First Delivery

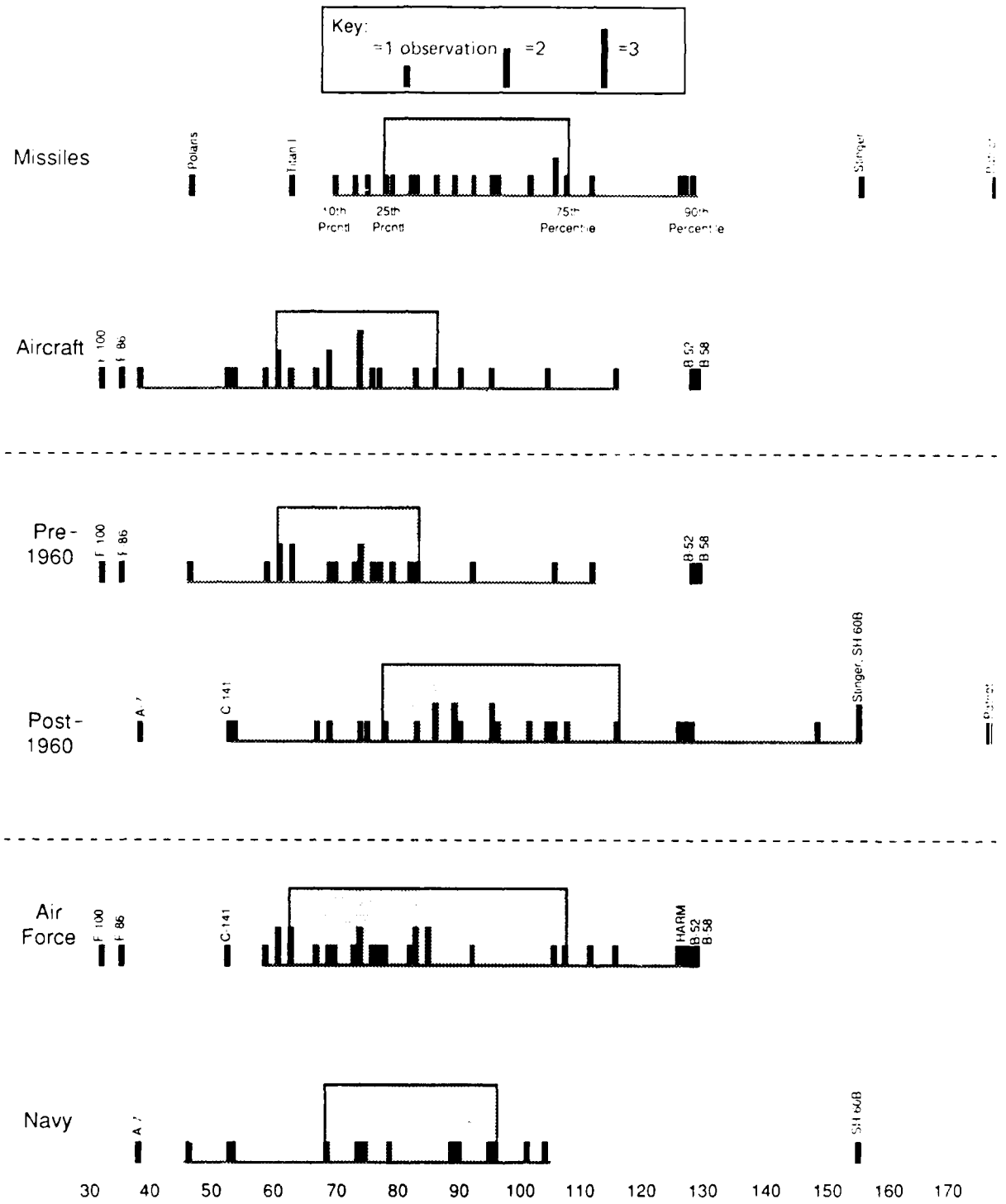

Fig. 1 — Distribution of months from program start to first delivery

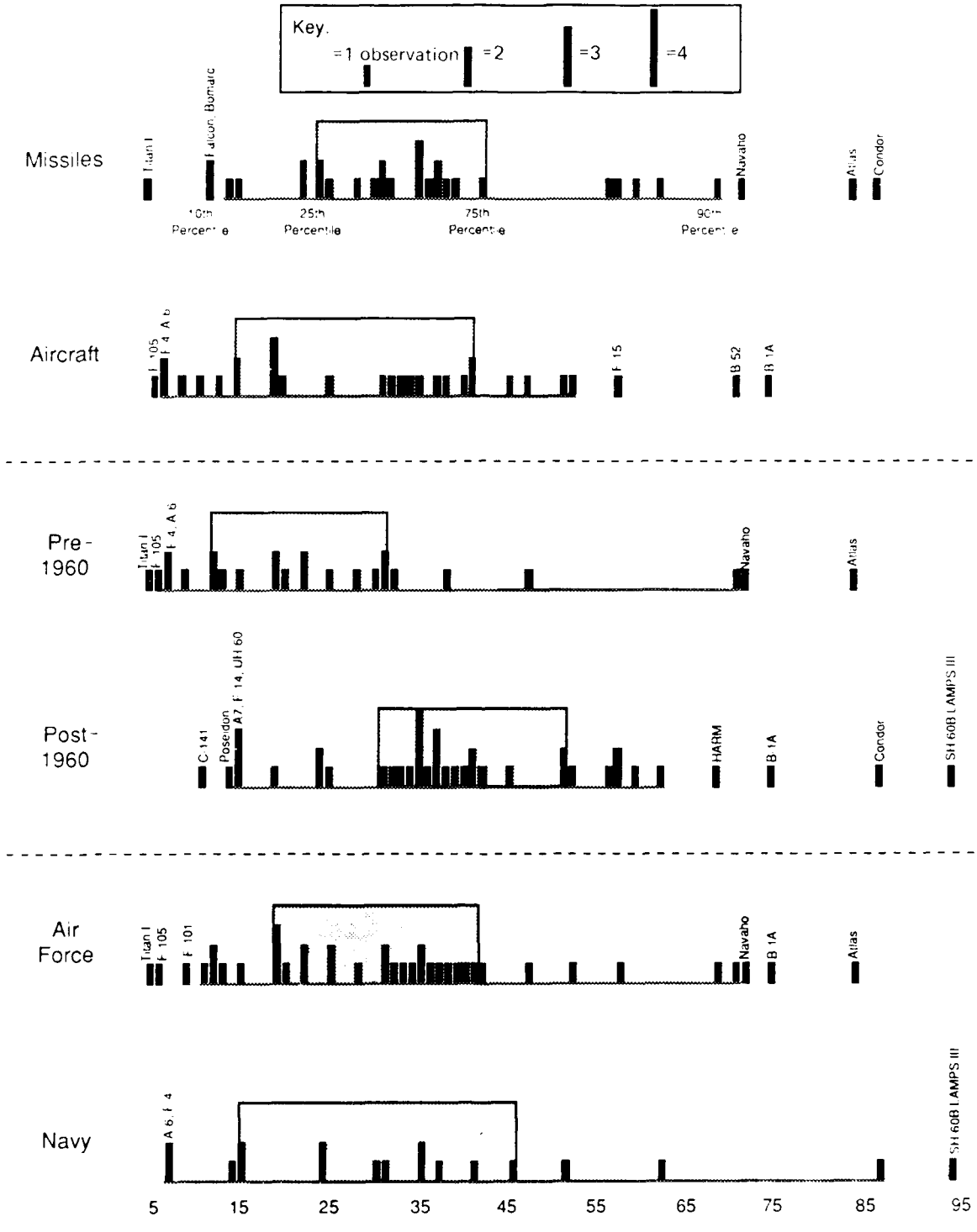

Fig. 2 – Distribution of months from program start to FSD start

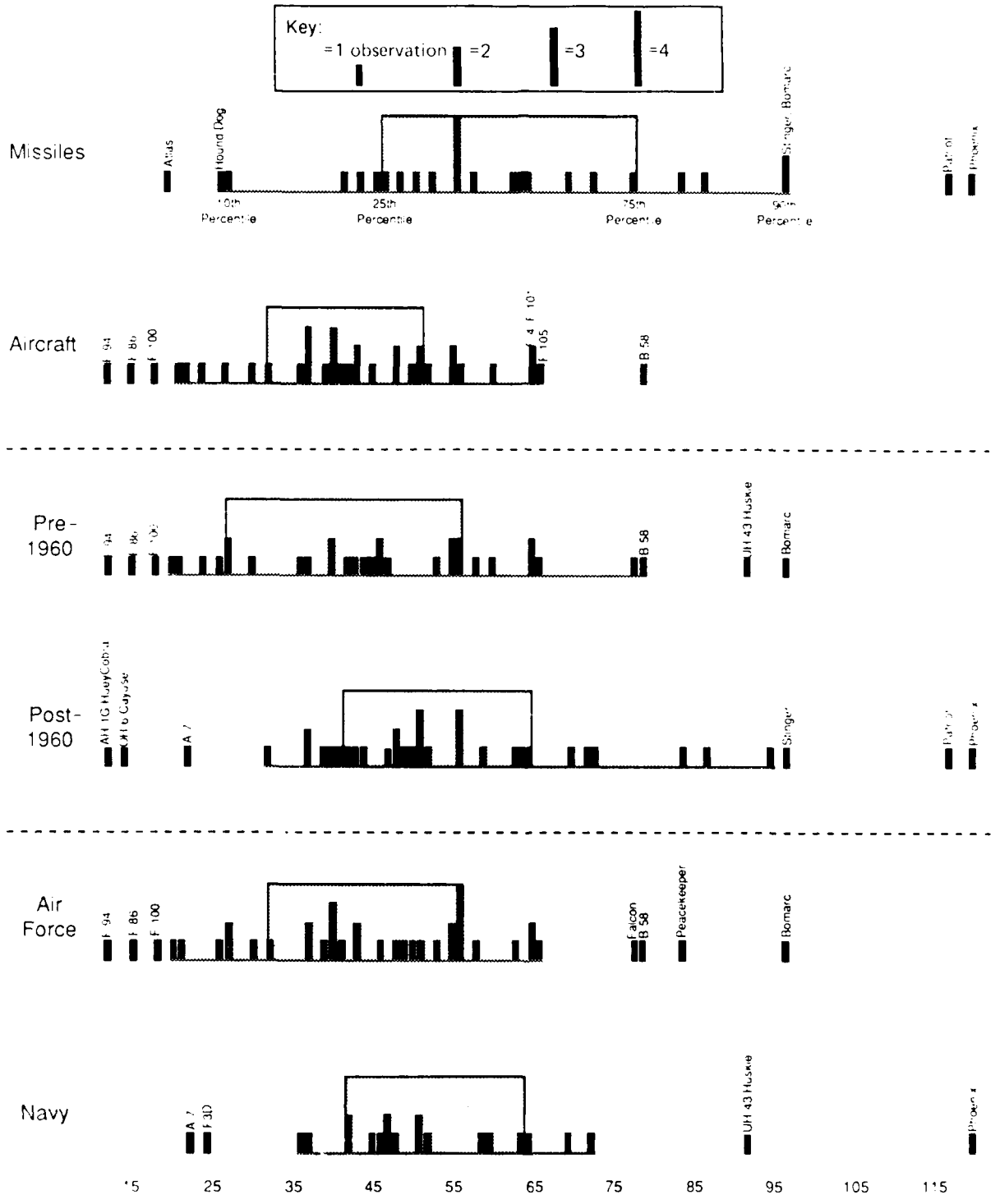

Fig. 3 — Distribution of months from FSD start to first delivery

constituent periods, program start to FSD start and FSD start to first delivery. The shaded areas mark the inter-quartile range, the shaded line marks the range from the tenth percentile to the ninetieth percentile and system name marks points beyond this range. The data are grouped into three pairs of comparison sets: missiles versus aircraft (helicopters excluded because of small sample size), pre-1960 program starts versus post-1960 program starts, and Air Force versus Navy (Army excluded because of small sample size). We test the pre- and post-1960 difference because many commentators contend that the centralization of acquisition management in the Department of Defense, which began at this time, has had an effect on acquisition pace.

All of these sets have wide ranges and all of the comparison pairs have substantial overlap. Although missiles and aircraft, and pre-1960 and post-1960, appear to be slightly different in some of the periods, these differences are minor compared with the ranges of the data. Statistical testing confirms these conclusions. Table 3 shows results of tests using the Mann-Whitney U, a statistic that represents the distributional differences between two sets that are not normally distributed. None of these probabilities is close to the 5 percent significance level.

Previous studies, including the A3 Study and R-2605-DR&E/AF, graphed acquisition intervals against the year of full-scale development start. Although full-scale development start is the easiest date to consistently identify, it is not a good surrogate for the effect of date on schedule. The management system of a program is fixed well before FSD start. Systems already in development are not and can not usually be "grandfathered" into a new management or oversight system. In the following regression analyses we use program start as the independent variable. This variable better represents the time-dependent conditions, such as management method and bureaucratic structure, that influence each system's development pace.

Figure 4 shows the overall interval from program start to first delivery for all of the systems in the sample for which we could identify that interval. Airplanes are coded with crosses, missiles with squares, and helicopters with diamonds.

Table 3

STATISTICAL COMPARISON BETWEEN DATA GROUPINGS BY MANN-WHITNEY U TEST[a]

Item	Program Start to FSD Start			FSD Start to First Delivery			Program Start to First Delivery		
	Obs[b]	Army	Navy	Obs	Army	Navy	Obs	Army	Navy
Army	8	-	-	10	-	-	7	-	-
Navy	18	0.47	-	22	0.49	-	14	-	-
Air Force	39	0.48	0.50	40	0.49	0.49	31	-	0.50
	Aircraft			**Aircraft**			**Aircraft**		
Aircraft	30	-		36	-		25	-	
Missiles	32	0.49		27	0.48		24	0.48	
	Pre 1960			**Pre 1960**			**Pre 1960**		
Pre 1960	25	-		35	-		23	-	
Post 1960	40	0.48		37	0.49		29	0.48	

[a] The Mann-Whitney U Test first pools the observations from the individual comparison sets (with total observations n_1 and n_2) and ranks the N observations of the total set. It then calculates the statistic $U = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - S_1$, which is the number of possible combinations of observations from the two sets where the observation from set one is less then the observation from set two. If U is greater then the expected result, $U > \frac{n_1 n_2}{2}$, then the statistic U′ is calculated: $U' = n_1 n_2 - U$. The smaller of U and U′ is used to calculate the normal statistic,

$$Z = \frac{\left(U - \frac{n_1 n_2}{2}\right)}{\sqrt{\frac{n_1 n_2}{N(N-1)}\left(\frac{N^3 - N}{12} - \sum T_i\right)}}$$

, and two tailed tests are performed. For tied observations, $T_i = t^3 - t$ is calculated where t is the number of observations tied for rank i. The statistic shown in the table is the probability of observing U assuming that the two comparison groups are taken from the same population. A probability less then 0.05 indicates a statistically significant difference between the distribution of the two groups.

[b] Observations.

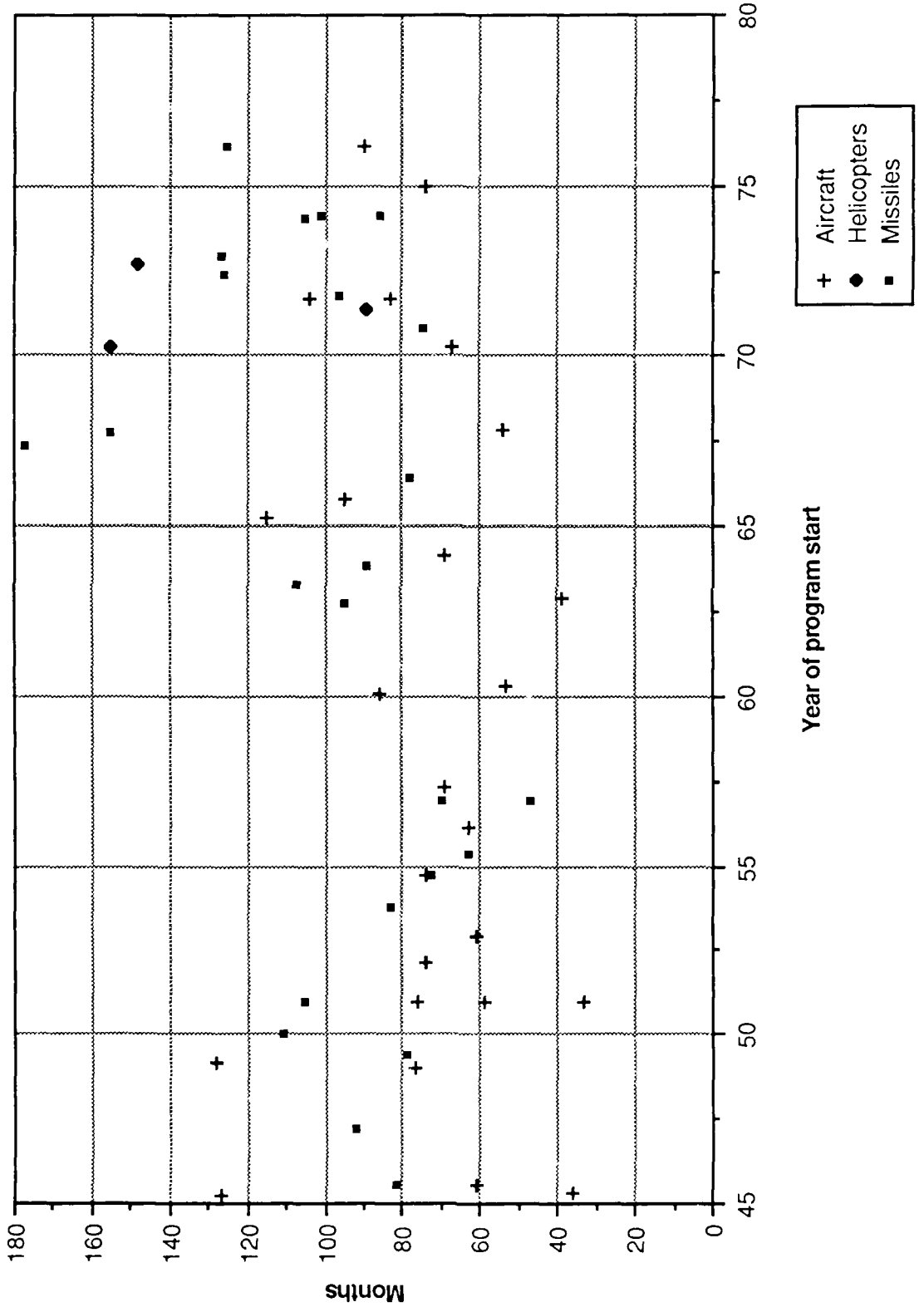

Fig. 4 Time from program start to first delivery: all systems

It is obvious that a large variation from system to system occurred throughout the 35 years covered in the figure. Even in the late 1940s, a period frequently associated with rapid acquisition, some systems took over ten years to proceed from program start to first delivery. These data cannot be well approximated with a function whose only independent variable is calendar date. Although there is some increase from 1945 to 1975 in the average length of the development cycle, the time variable accounts for only a small portion of the observed variance in the data.

Figures 5 and 6 show the the combined data sample (aircraft, helicopters, and missiles) for the two separate intervals: program start to FSD start, and FSD start to first delivery.

It is interesting to examine the two classes of systems, aircraft and missiles, separately. This approach suffers in comparison with the combined sample because there are fewer data points in the individual system samples, but it avoids the problem of mixing widely different kinds of systems in one data set. Figs. 7 to 9 show interval time as a function of program start date for airplanes; Figs. 10 to 12 show missiles. There are too few helicopter data points for a separate analysis.

None of the graphs shows strong evidence of a relationship between interval length and calendar time. We performed statistical analysis of the data to confirm the visual interpretation. In most cases, an exponential function yielded slightly better statistical relationships than a linear function. Table 4 shows the number of points, fitted constant, slope, and adjusted R-squared value for each graph. Slopes that are significant at the five percent level are highlighted in bold print.

There is no relationship between development pace and calendar time for aircraft: outliers in the pre-1950 period prevent good fits. In the graphs of missiles from program start to FSD start and from program start to first delivery, exponential fits are significant and account for 19 percent and 14 percent of the variance, respectively. For the all-systems graphs (aircraft, missiles, and helicopters), there are significant trend lines but even weaker fits for the interval from program start to FSD start and for the total development interval.

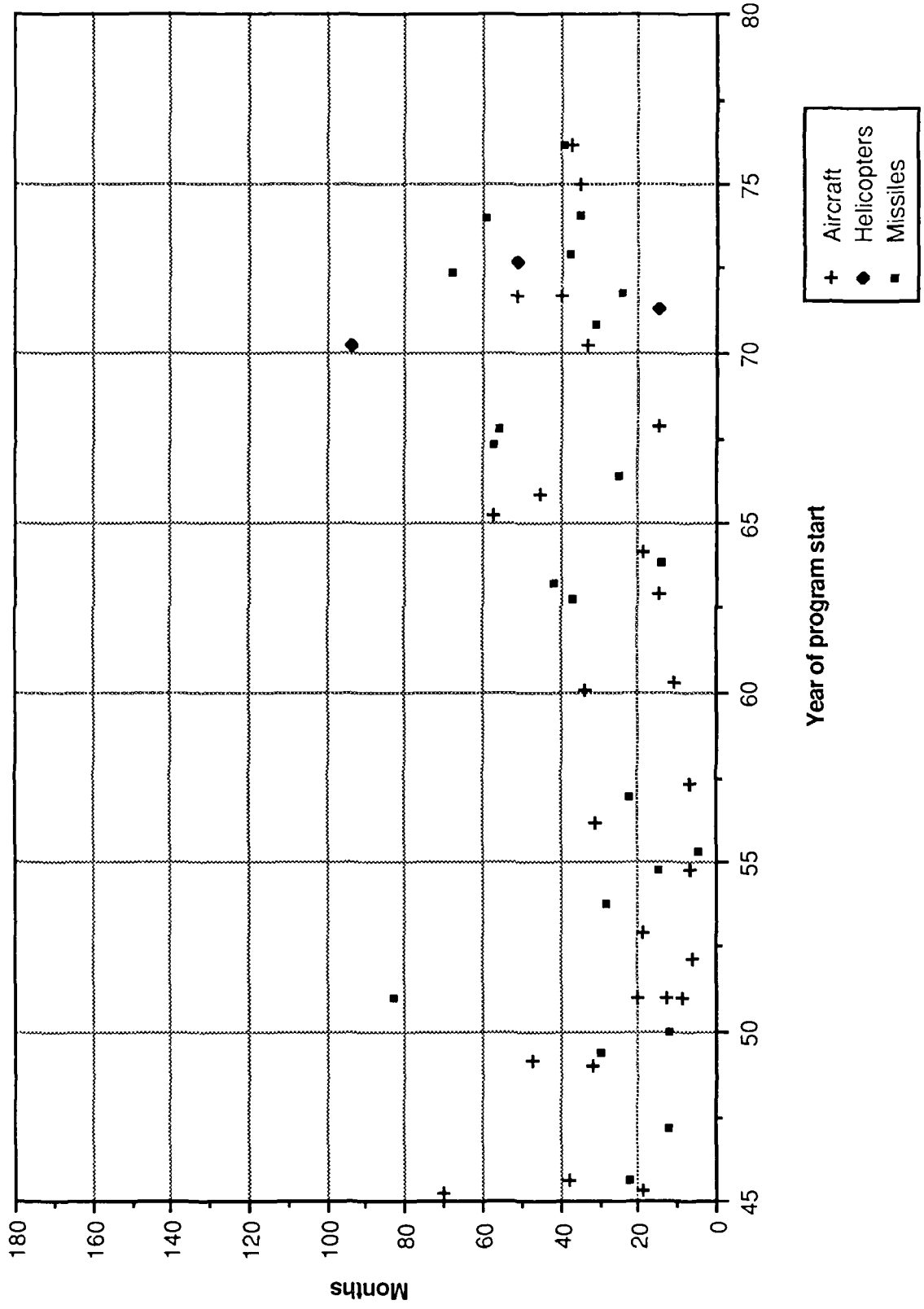

Fig. 5 - Time from program start to FSD start: all systems

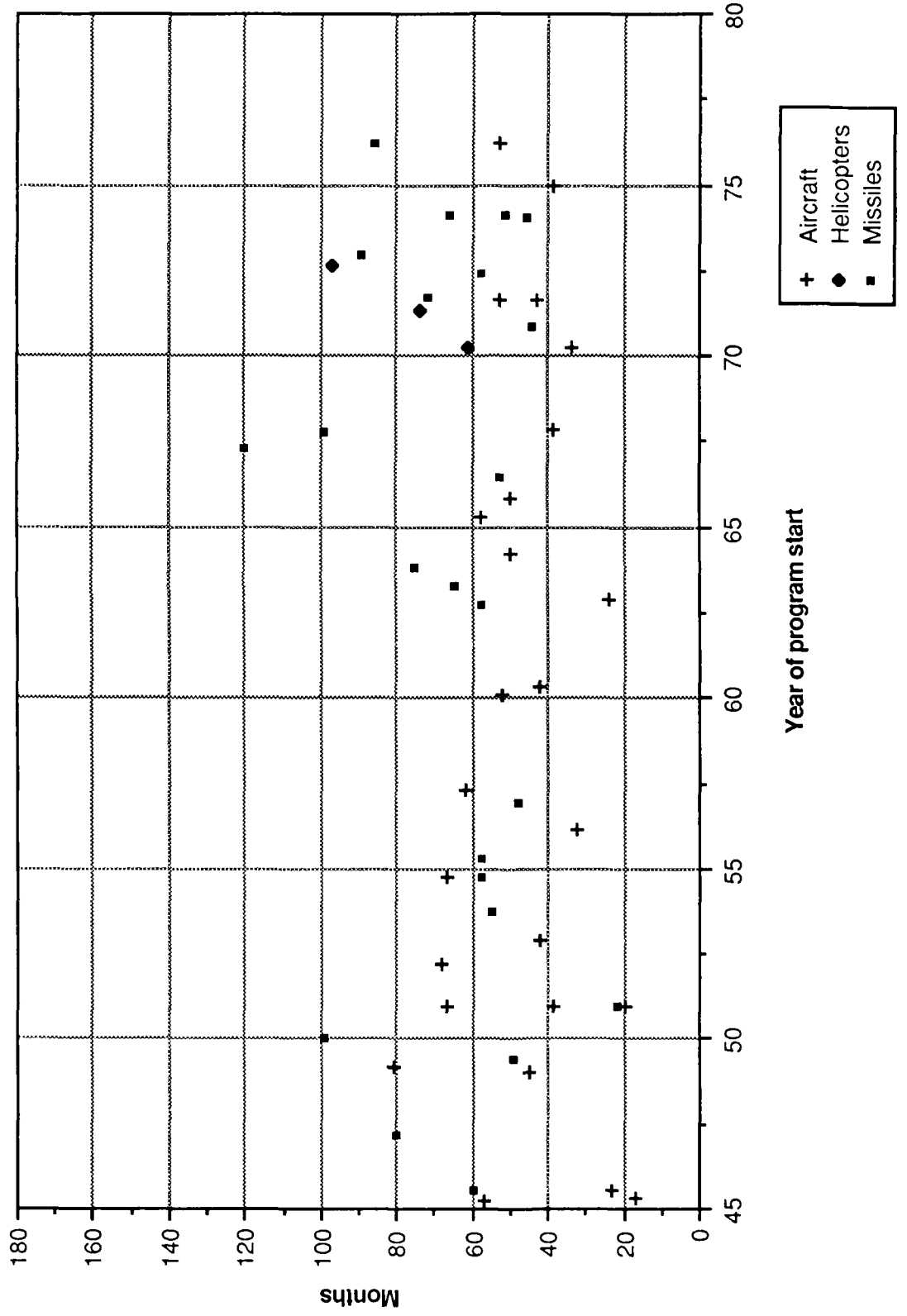

Fig. 6—Time from FSD start to first delivery: all systems

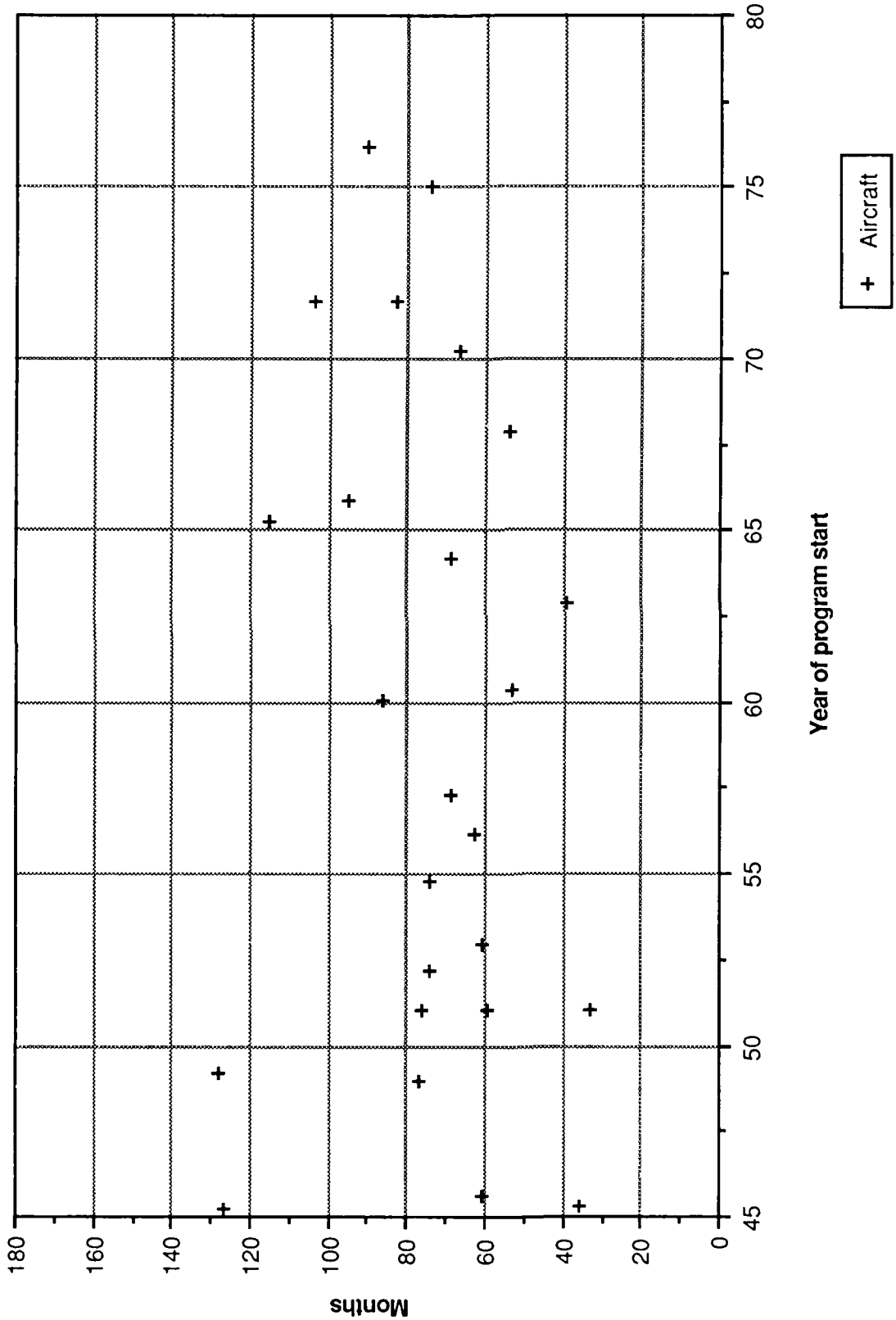

Fig. 7—Time from program start to first delivery: aircraft

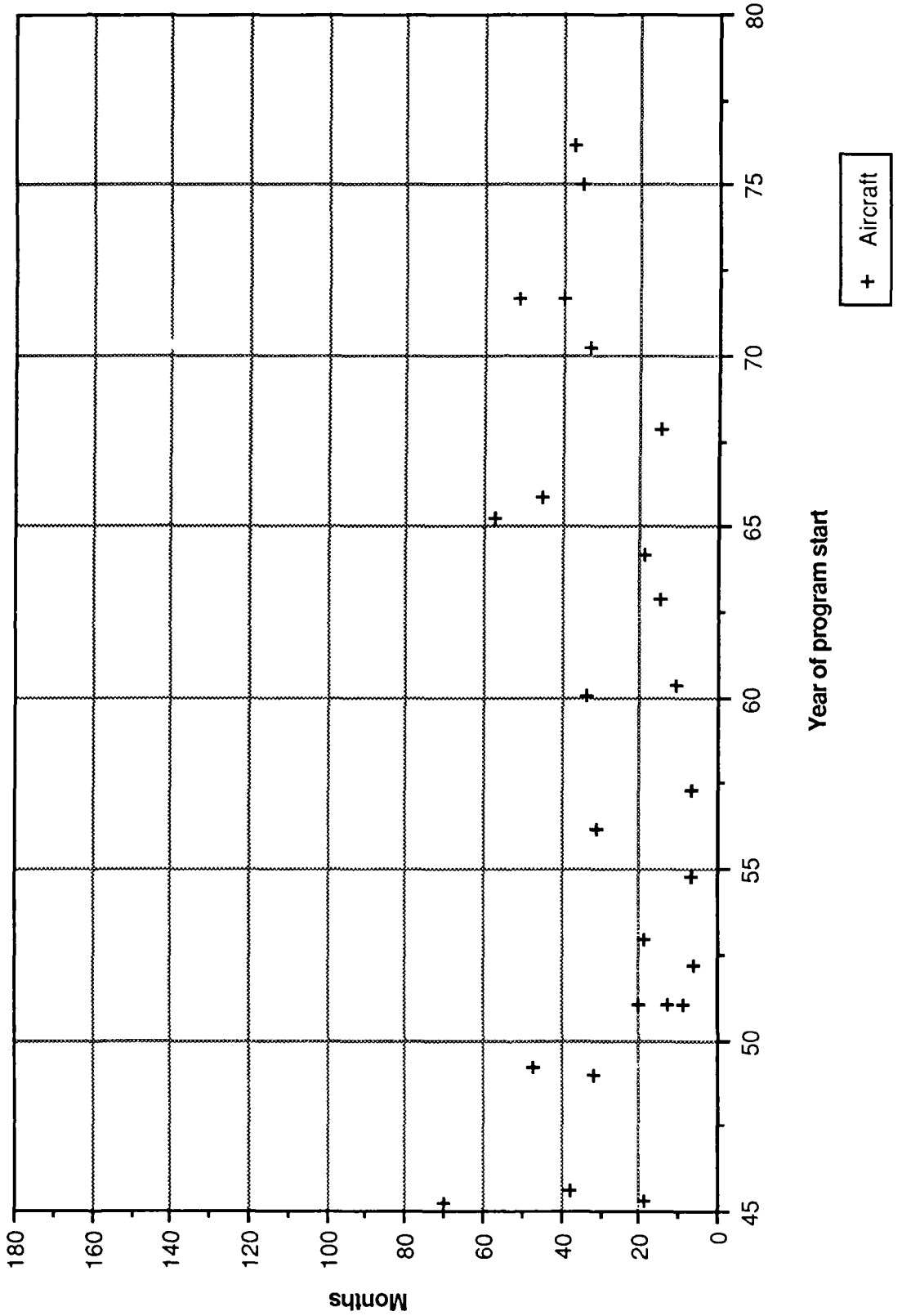

Fig. 8—Time from program start to FSD start: aircraft

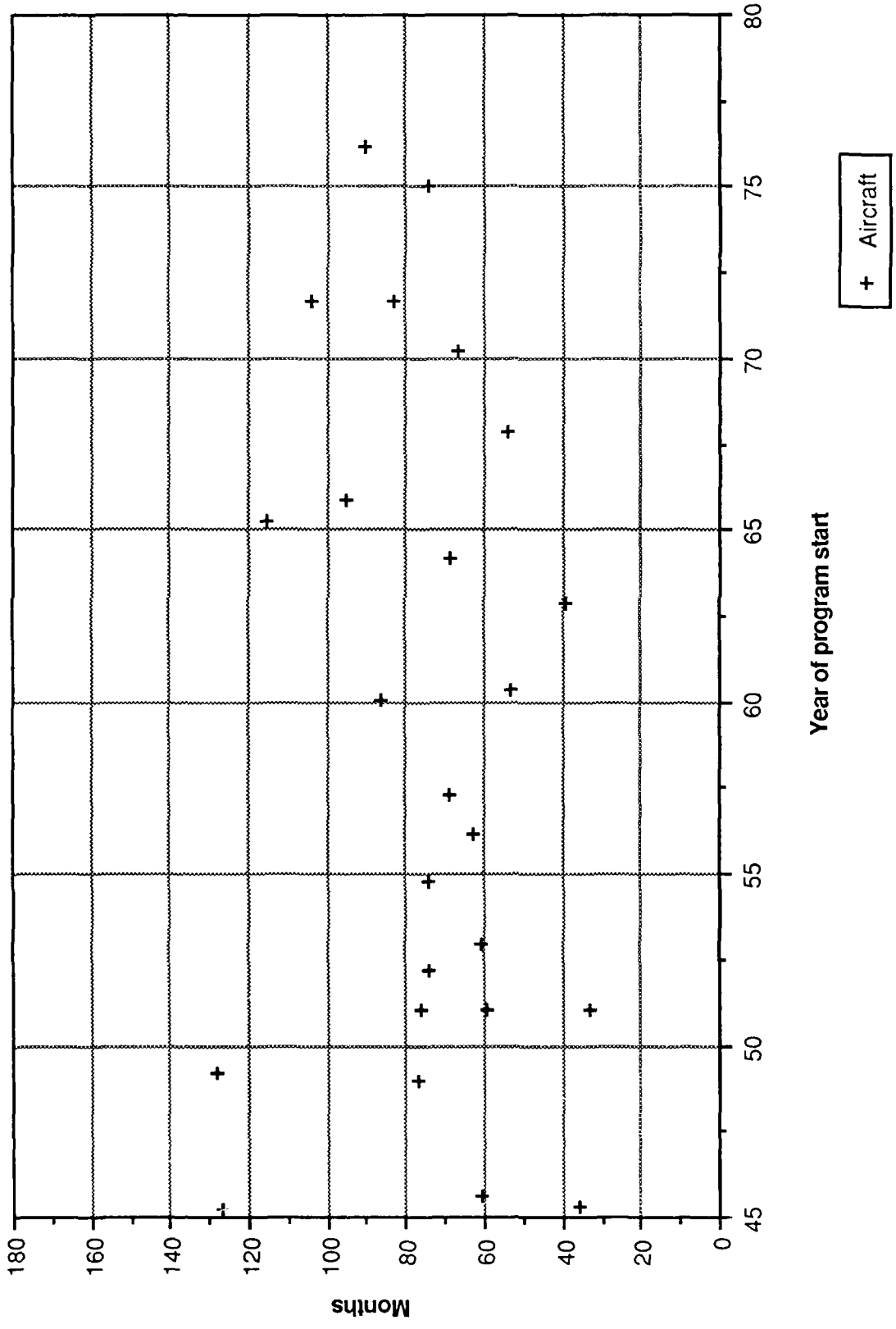

Fig. 9– Time from FSD start to first delivery: aircraft

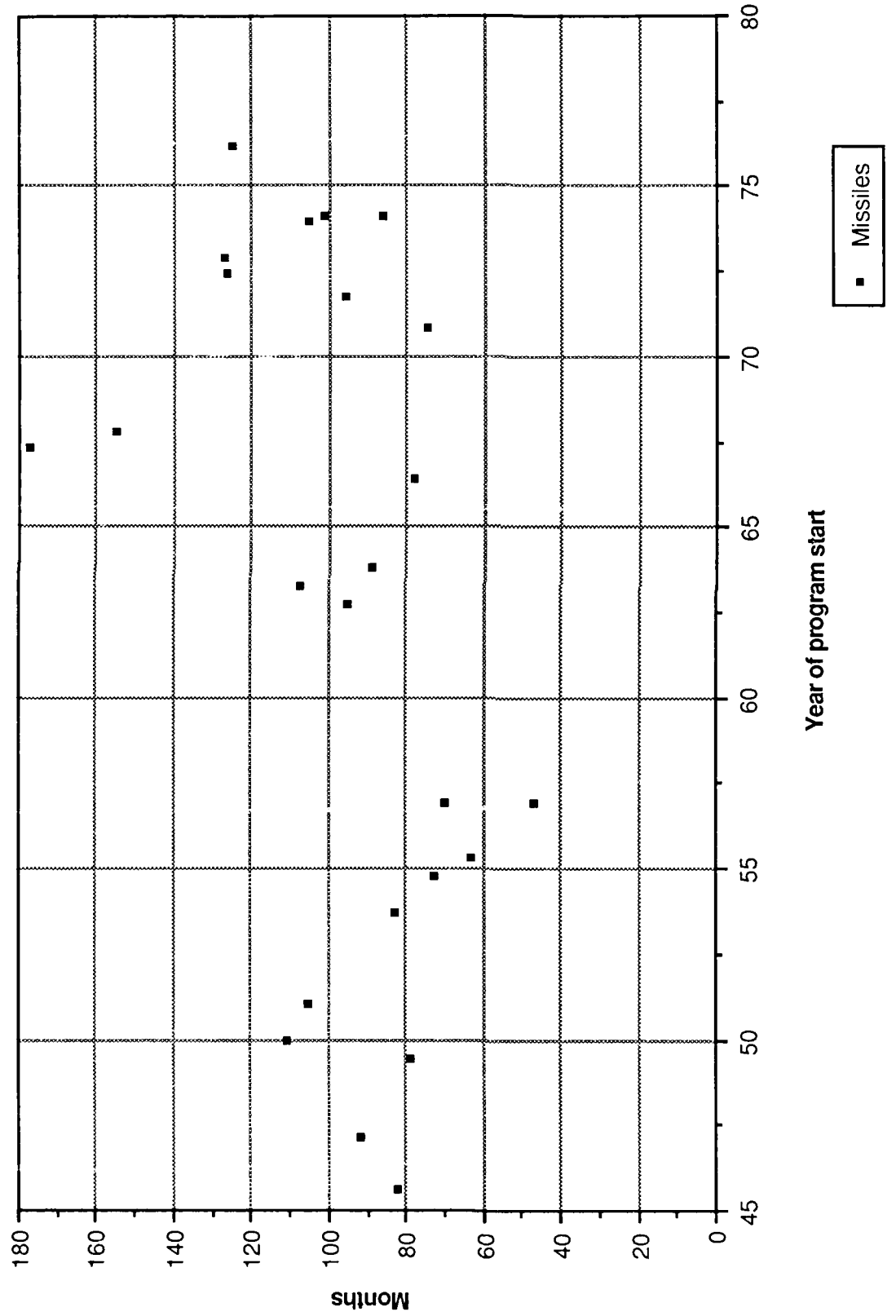

Fig. 10—Time from program start to first delivery: missiles

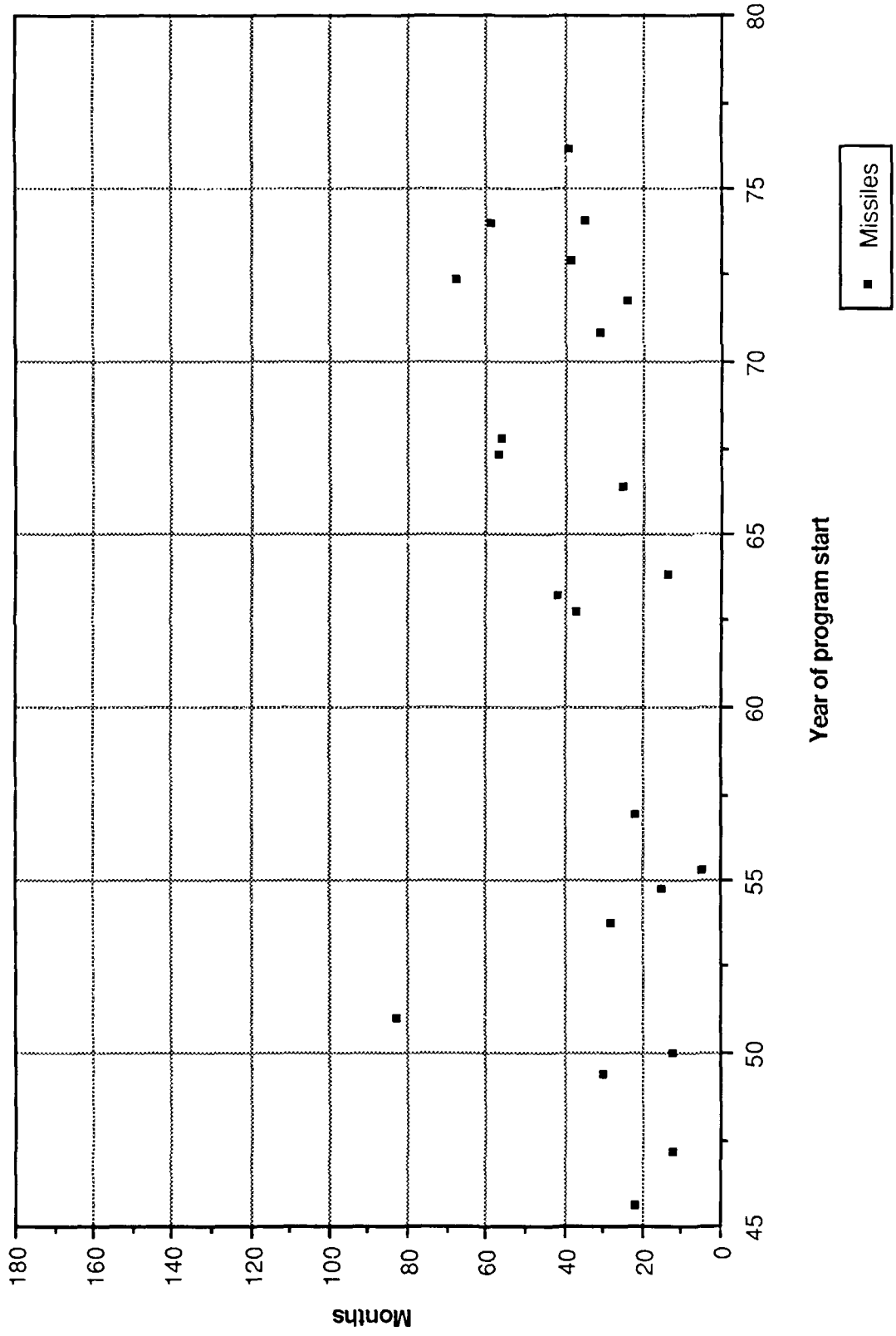

Fig. 11 - Time from program start to FSD start: missiles

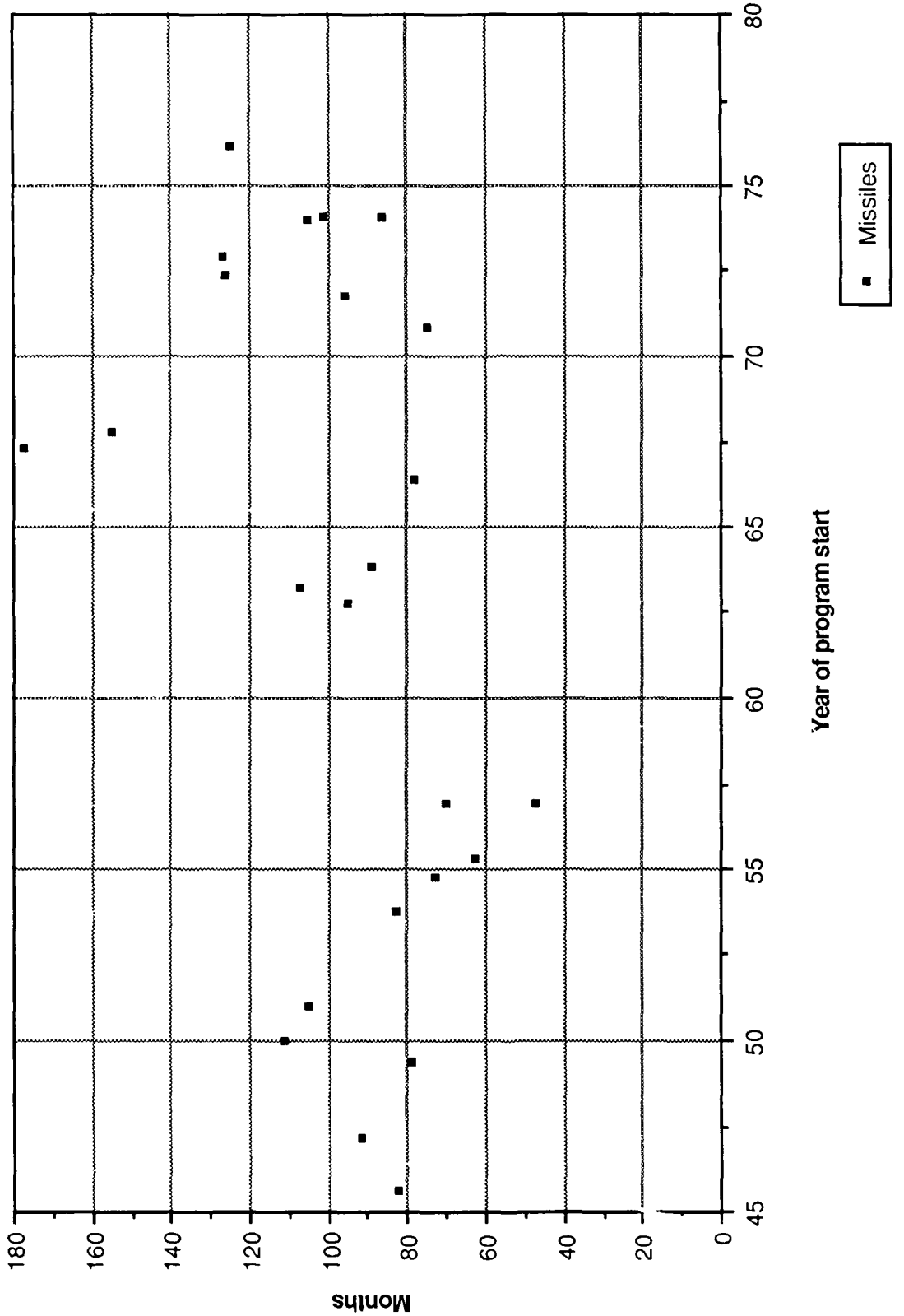

Fig. 12—Time from FSD start to first delivery: missiles

Table 4

SUMMARY OF REGRESSION STATISTICS

Vertical Axis	Obs[a]	Constant	Slope	Adj R-sqr	Fig. no.
Aircraft					
Prog start to FSD start	25	10.58	0.30	-1.3%	8
FSD start to first del	25	45.46	0.01	-4.3%	9
Prog start to first del	25	56.04	0.32	-2.8%	7
ln (prog start to FSD start)	25	2.10	0.02	1.7%	8
ln (FSD start to first del)	25	3.44	0.01	-2.5%	9
ln (prog start to first del)	25	3.85	0.01	-0.5%	7
Missiles					
Prog start to FSD start	**23**	**-11.35**	**0.73**	**10.1%**	**11, 16**
FSD start to first del	23	43.02	0.37	-1.8%	12
Prog start to first del	**24**	**22.18**	**1.22**	**13.5%**	**10, 15**
ln (prog start to FSD start)	**23**	**1.42**	**0.03**	**19.0%**	**11, 16**
ln (FSD start to first del)	23	3.70	0.01	-0.7%	12
ln (prog start to first del)	**24**	**3.77**	**0.01**	**14.2%**	**10, 15**
All Systems					
Prog start to FSD start	**51**	**-6.84**	**0.65**	**8.3%**	**5, 14**
FSD start to first del	51	27.37	0.48	3.0%	6
Prog start to first del	**52**	**17.64**	**1.17**	**11.9%**	**4, 13**
ln (prog start to FSD start)	**51**	**1.64**	**0.03**	**12.8%**	**5, 14**
ln (FSD start to first del)	51	3.27	0.01	5.4%	6
ln (prog start to first del)	**52**	**3.58**	**0.01**	**12.8%**	**4, 13**

[a] Observations.

Although there is some significant upward trend, large variability before 1951 and after 1965 distorts the slope and causes low adjusted R-squared values. In all categories there is no significant relationship in the period from FSD start to first delivery. This result is a mild confirmation of the 1980 RAND report (R-2605-DR&E/AF) that found a lengthening period from program start to FSD start, and a stable FSD duration.

The weakness of these trend lines in describing acquisition pace is best shown graphically. Figures 13, 14, 15, and 16 show fit lines significant at the five percent level for Figs. 4, 5, 10, and 11 (all systems A to C, all systems A to B, missiles A to C, and missiles A to B). Only the linear line is shown in Fig. 16 because the exponential line looks the same. In Fig. 13 points are unevenly and irregularly distributed above and below the fit line, yielding a poor R-squared statistic and a poor visual fit. In Fig. 14, the fit lines are skewed

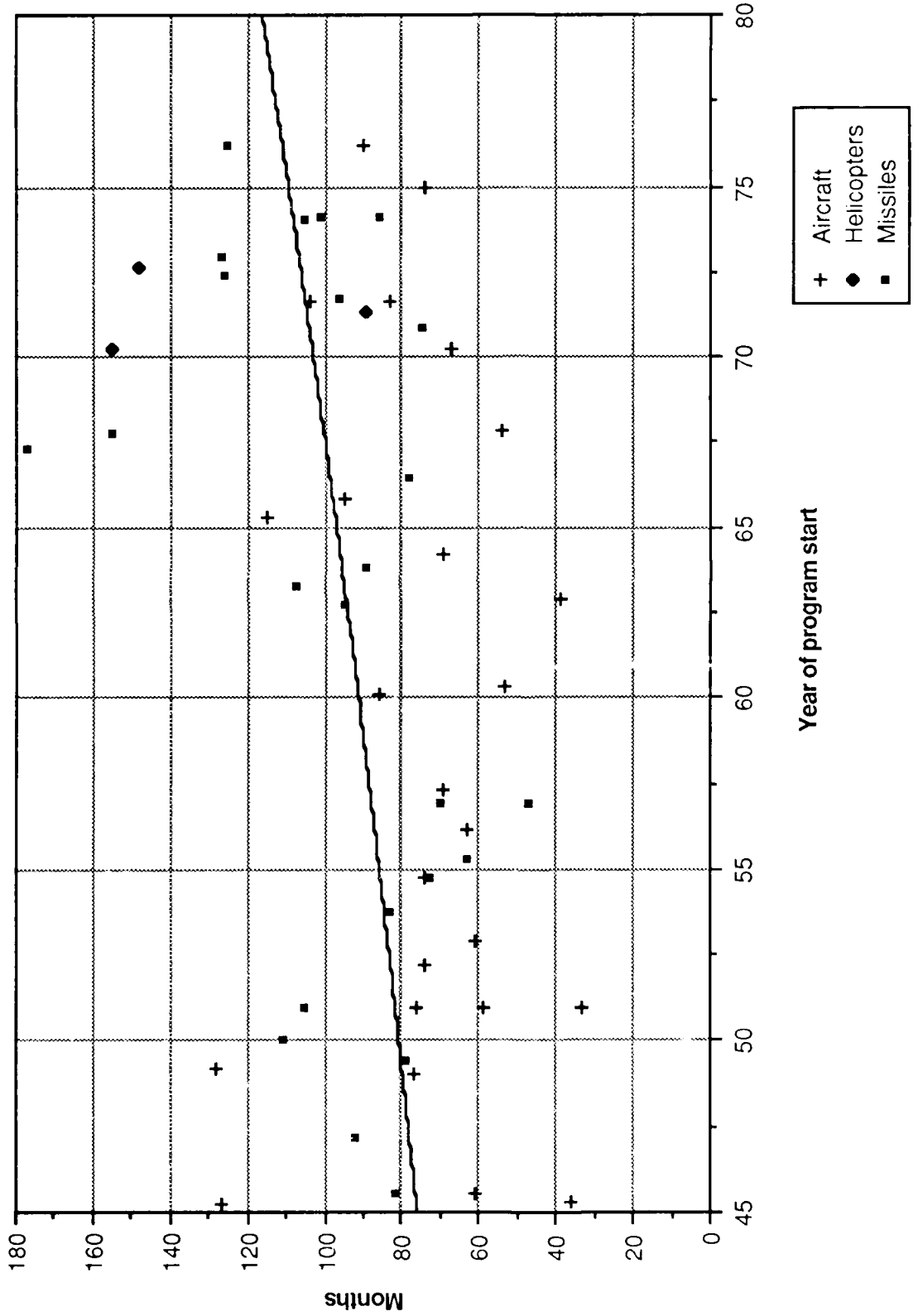

Fig. 13—Time from program start to first delivery with exponential fit line: all systems

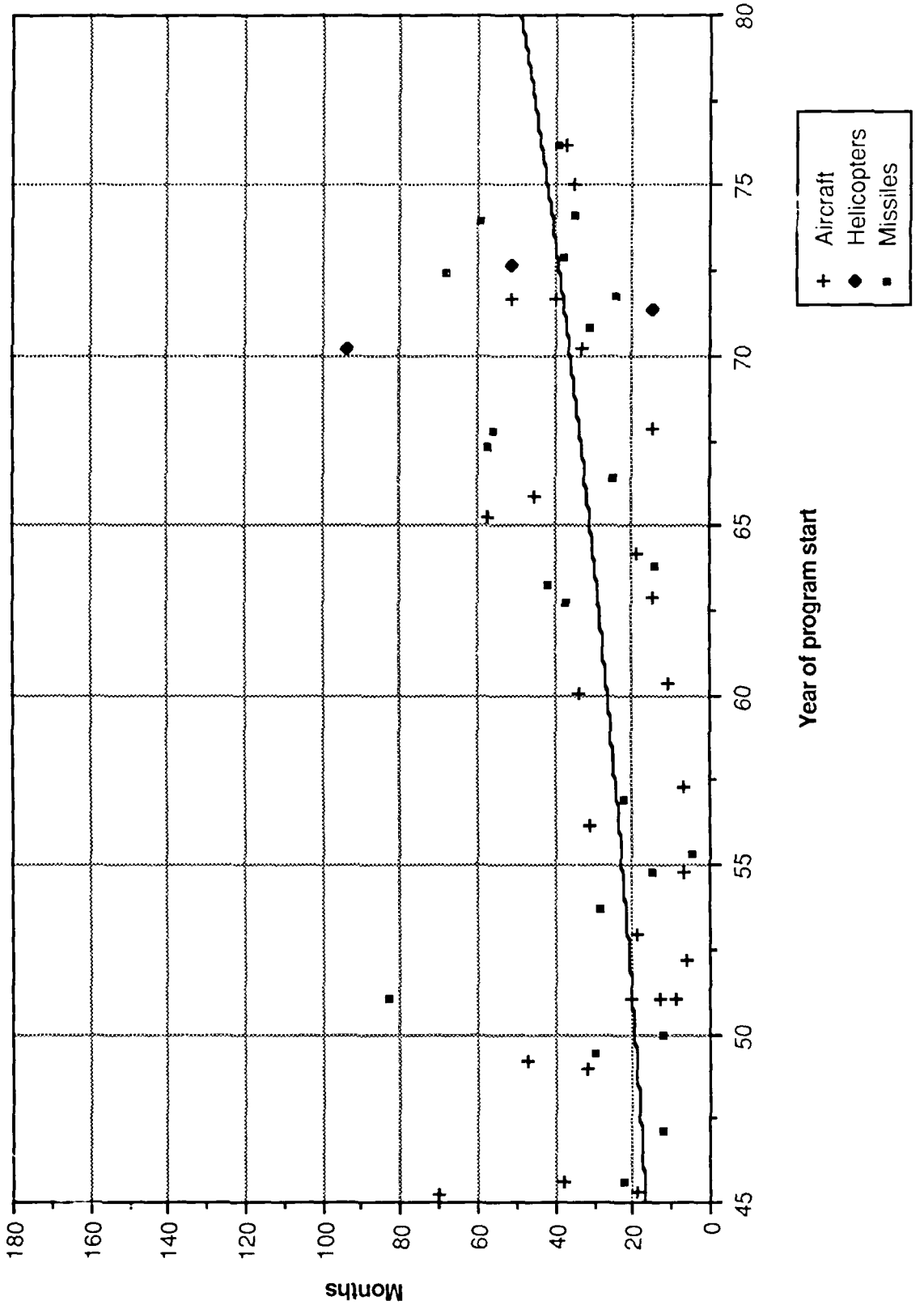

Fig. 14—Time from program start to FSD start with exponential fit line: all systems

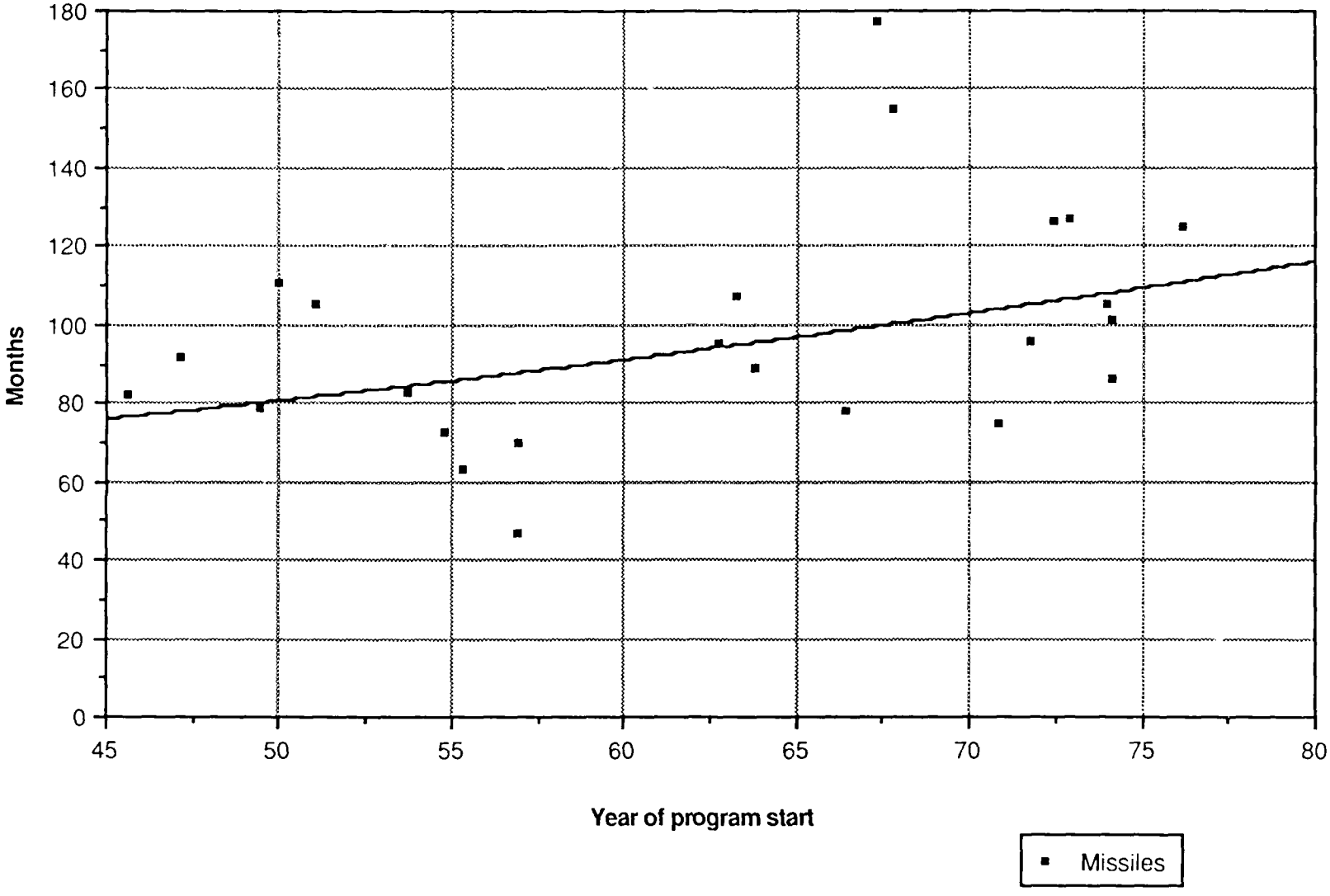

Fig. 15 Time from program start to first delivery with exponential fit line: missiles

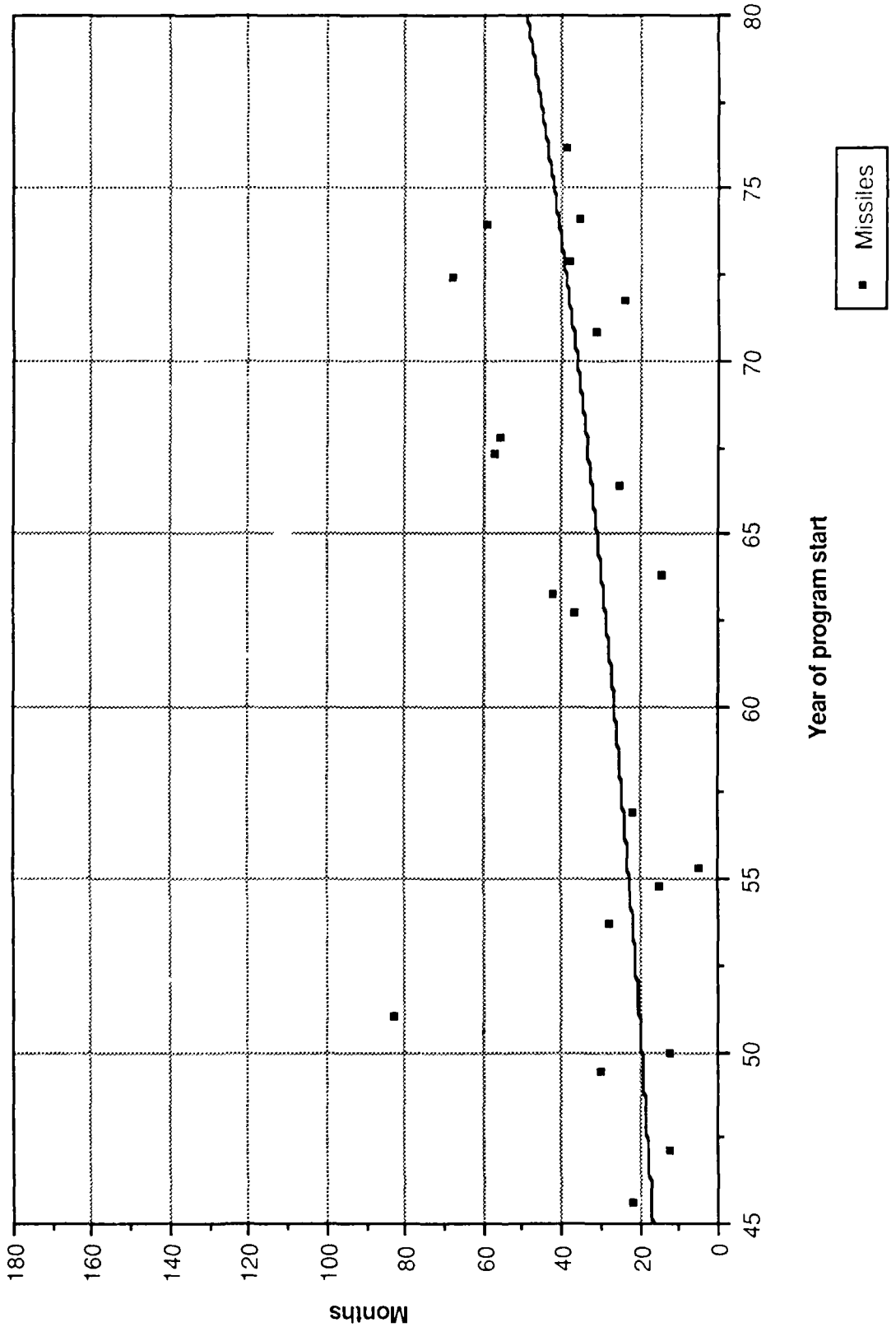

Fig. 16 Time from program start to FSD start with exponential fit line: missiles

upward by high outliers before 1951 so that points are primarily below the fit lines early in the time period and above the fit lines later in the period. Distant outliers in Fig. 15 cause poor fit. Figure 16 shows the best fit, and would be much better without the one outlier (Atlas).

To test the hypothesis that the centralization of procurement management that began around 1960 had an effect on acquisition time, we performed separate analyses on the post-1960 data. However, large variance in the data and a short range of years (1960 to 1977) combined to yield no significant relationships. We were unable to include more recent systems because they have not yet been delivered to the operational forces.

It is easy to conclude that our subgroupings (missiles, aircraft, and helicopters) are too general to provide useful results. We group together simple "off-the-shelf" cargo planes (KC-10A) with complex long-range strategic bombers (B-52 and B-1). However, more refined categorization does not yield more significant distributional differences or regression fits. Inspection of the data shows why this is the case; within potential subcategories there are large ranges in the data. For example, Atlas and Titan I, similar systems developed at almost the same time, differ in total development time by three and one-half years. However, even if there are significant differences between groupings at the subcategory level, we are limited by small sample size from analyzing the data at that level. With a more complete set it may be possible to separately analyze ICBMs, SAMs, air-to-ground weapons, air-to-air weapons, and ground-to-ground weapons.

Given the limitations of our data set, the most important finding of this work is that calendar time does not adequately account for the variance in the data on development time. In addition, groupings of systems beginning before and after 1960 do not differ significantly. Other variables must be included to bring in the outliers and improve the fit, and more data must be gathered to permit anlaysis of subgroups of systems. Calender time is not a surrogate for the factors that determine acquisition pace. Experts on acquisition have always believed that the mechanisms affecting development time are more complex than this simple model, and this analysis confirms that belief.

Appendix A

AIRPLANES

F3D DOUGLAS SKYNIGHT

- o First jet-propelled night fighter[1]
- o Deployed to Korea soon after the war there began, Skynights were responsible for the destruction of more enemy aircraft than any other type of aircraft flown by the Navy or Marines
- o Two-seat, jet-propelled, carrier-based, all-weather fighter

Milestone	Date	Event	Source
	3 April 1946	Contract issued to Douglas for design and construction of three prototypes	18; 29
	23 March 1948	First F3D prototype flight	18; 29
B	June 1948	28 F3D-1s purchased	29, p. 415; 18
	13 February 1950	First production F3D-1 flown	18, p. 182; 147a, p. B-129
	May 1950	First of 28 F3Ds completed	29
C	August 1950	First F3D-1 accepted	
	December 1950[2]	First F3Ds delivered to Night Composite Squadron VC-3 at Moffett Field	43
	April 1953	200th delivery	

[1]The designation for fighter aircraft was changed from "P" to "F" on 11 June 1948 by the newly created USAF. For consistency throughout this listing, the "F" designation will be used.

[2]Reference 18 gives approximate delivery date as February 1951.

F-84 REPUBLIC THUNDERJET

- o Last of the subsonic fighter-bombers to see operational service with USAF
- o Flight-refuelling techniques for fighters were developed for this aircraft
- o First single-seat fighter-bomber capable of carrying a tactical nuclear weapon
- o Developed to test the GE-TG 180 jet engine

Milestone	Date	Event	Source
	11 September 1944	General Operational Requirement (GOR) issued	10, p. 23
A	October 1944	First design initiated	
	11 November 1944[3] (Prototype start)	First development contract for 3 fighter airplanes for static test, flight article mock-up	10, p. 23
B	4 January 1945[4]	AAF ordered 100 service test and production F-84s	10, p. 24
	November 1945[5]	First prototype completed	47
	28 February 1946[6]	First flight XF-84 at Muroc AFB, California	10, p. 25; 9; 147a, p. B-190
	August 1946	Second XF-84 prototype completed	9, p. 214
	6 September 1946[7]	Second XF-84 sets speed record	9, p. 214; 20
	January 1947	First flight of YF-84	
	February 1947[8]	AF takes delivery of 15 YF-84As	10, p. 26
C	June 1947	First production deliveries of F-84B	17, p. 463
	December 1947	Enters operational service	10, p. 26
	April 1948	200th delivery	10, p. 27
	November 1950	TAC begins development of the F-84 to carry nuclear bombs for tactical warfare	17, p. 464
	Spring 1952	F-84G--first single-seat fighter bomber with atomic capability	17, p. 464
	June 1953	Last delivery	137, p. 36

[3]Reference 9, p. 214, confirms the order for three but dates it as early 1945.

[4]Reference 47 gives December 1944 as date of quantity order.

[5]Reference 9, p. 214, gives completion date as December 1945.

[6]Reference 47 dates first flight one day earlier--26 February.

[7]Reference 10, p. 25, claims second prototype flew in August and established speed record in September.

[8]Reference 29, p. 257, gives April 1947 as first acceptance.

F-86 NORTH AMERICAN SABRE

- o USAF's first swept-wing fighter
- o First American fighter to pass Mach 1
- o Significantly increased our air power in Korean War
- o Design influenced by German scientific data on swept-wing

Milestone	Date	Event	Source
	22 November 1944	North American begins RD-1265 design study proposing high-performance jet fighter for Air Force	114, p. 4; 29a, p. 12
	11 April 1945[9]	GOR issued	
A	18 May 1945[10] (Prototype start)	Letter contract for 3 XF-86 prototypes (straight-wing design), company design NA-140	114; 19; 29a, p. 12
	28 May 1945	Navy approves contract for 100 production FJ-1's (NA-141)	29a, p. 12
	June 1945	USAF approves first version mock-up	114
	August 1945	Wind tunnel testing of swept-wing aircraft authorized	29a, p. 13
	1 November 1945	AF endorses North American's proposal to scrap the straight-wing design in favor swept-wing (design study RD-1369)	10; 114; 9, p. 225; 29a, p. 13
	28 February 1946	AF approves cockpit and swept-wing mock-up	114; 29a, p. 13
	9 August 1946	North American releases their XF-86 engineering drawings to the manufacturing division	114; 29a, p. 14
	27 November 1946	Navy XFJ-1 makes first flight	29a, p. 14
B	20 December 1946	Production go-ahead for 33 F-86s	10, p. 53; 114; 29a, p. 19
	20 June 1947	Basic release of engineering drawings for F-86A	29a, p. 19
	8 August 1947	First of 3 XF-86s completed and turned over for flight tests	114; 5a, p. 15
	1 October 1947	First prototype flight, XF-86	9, p. 225; 10; 114; 147a, p. B-196; 20; 5a, p. 122; 29a, p. 16
	16 October 1947	Final approval to fixed price contract for 33 F-86A's plus supplemental authorization for 190 F-86B's	29a, p. 19

Milestone	Date	Event	Source
	October 1947	Deliveries of Navy's FJ-1 begin	29a, p. 19
	16 December 1947	Contract changed to include 188 F-86A-5s and 2 F-86C's instead of 190 F-86B's	29a, p. 19
	26 April 1948[11]	XF-86, equipped with Allison TG-180 (J-35) engine, becomes first American fighter to exceed Mach 1	22, p 258; 46; 114; 29a, p. 17
	20 May 1948[12]	First flight production aircraft, F-86A-1	10, p. 54; 20 , p. 258; 147a, p. B-196; 29a, p. 20
C	28 May 1948[13]	First production acceptance	137, p. 38; 29a, p. 20
	29 May 1948	Contract for additional 333 F-86A's	29a, p. 22
	February 1949	Enters operational service with First Fighter Group's 94th Squadron at March AFB	10, p. 54; 29a, p. 23
	4 March 1949	Officially named Sabre	29a, p. 23
	October 1949	200th delivery	
	8 November 1950	Sabres ordered into combat in Korea	9, p. 225
	17 December 1950	F-86 flew first mission in Korea	10, p. 54
	October 1955	Last delivery	137, p. 38

[9]Reference 10, p. 53, gives GOR date as May.

[10]Reference 10, p. 53, claims only two prototypes were ordered; Ref. 8 notes that three Navy prototypes, ordered 1 January 1945, were built and flown as conventional straight-wing aircraft.

[11]Reference 9, p. 225, gives April 26.

[12]Reference 17 states May 18 as first production flight.

[13]Reference 8, p. 42, gives December 1948 as the date of F-86A service delivery.

F-89 NORTHROP SCORPION

- o All-weather ground attack fighter
- o Designed to succeed P-61 Black Widow

Milestone	Date	Event	Source
A	August 1945[14]	Advanced Development Objective (ADO)	
	28 August 1945	AF asks for design proposals	10
	23 November 1945	GOR/Specific Operational Requirement (SOR) issued	
	December 1945	Northrop submits their proposal to AF for all-weather ground attack fighter	9, p. 238; 29, p. 264; 17, p. 441
	March 1946	Six aircraft manufacturers enter competition	10, p. 83
	13 June 1946[15] (Prototype start)	Initial procurement--Northrop receives $4 million letter contract for two experimental F-89's	10, p. 84
	September 1946	Mock-up inspection	29, p. 264
	18 December 1946[16]	Contract for two experimental planes finalized	29, p. 264; 17, p. 441; 19
	16 August 1948	First flight of prototypes with J-35-A-9's	20; 10, p. 84; 5, p. 207; 29, p. 264; 147a, p. B-208
B	14 October 1948	Go-ahead decision	10, p. 84
	14 July 1949	Approval of F-89A contract; production orders placed	17, p. 442
	27 June 1950	YF-89A (second prototype modified with new engines, J-35-A-21s with afterburners) makes first flight	10, p. 86; 147a, p. B-208
C	28 September 1950[17]	First acceptance of production aircraft	10
	Mid-1951	F-89A and B began to reach ADC squadrons	17, p. 443
	January 1954	200th delivery	
	September 1956	Last delivery	137, p. 40

[14]Reference 10 gives "Spring" as ADO date; Ref. 137, p. 40, gives August 1945 as requirement date.

[15]Reference 17, p. 441, claims that Northrop's design was accepted and a development contract was issued on 3 May 1946; Ref. 29, p. 264, confirms May.

[16]Reference 10 disagrees; claims December marks second mock-up and Northrop is authorized to proceed with construction of first airplane.

[17]Reference 17, p. 442, and Ref. 29, p. 265, give July 1950 as the date for first F-89A delivery.

F-94 LOCKHEED STARFIRE

- o First jet-powered, all-weather fighter to enter USAF service
- o Two-place interceptor version of the F-80 "Shooting Star"
- o Designed for high-altitude, radar-controlled interception of enemy aircraft

Milestone	Date	Event	Source
	8 October 1948	GOR issued	10, p. 101
B	14 October 1948	Go-ahead decision on F-80 two-place modification; becomes F-94 in 1959	10, p. 101
	January 1949[18]	Letter contract with Lockheed	10, p. 101
		Initial procurement	
	16 April 1949[19]	First flight of XTF-80C (radar equipped TF-80C)	10, p. 101
	1 July 1949[20]	First flight of YF-94	10, p. 101; 17, p. 340
C	December 1949[21]	AF accepts first F-94A	10, p. 103; 29, p. 265
	August 1950	IOC	10, p. 102
	April	Enters operational service with ADC's 61st Fighter Interceptor Squadron at Selfridge AFB	10, p. 104

[18]This letter contract (L/C) was replaced a few months later by a definitive contract (AF-1849) covering 150 F-94s (later reduced to 109)--Ref. 10, p. 101.

[19]Reference 29 says this was the first flight of YF-94.

[20]Two T-33A trainers, improved and redesignated TF-80Cs, were modified for the interceptor role by adding radar noses and rear-fuselage afterburners. These aircraft were used by Lockheed as F-94 prototypes to speed development--Ref. 10, p. 101.

[21]There is little agreement on "delivery" and "enters operational service" dates. Reference 10, p. 102, says that the F-94A enters operational service and begins to reach air defense units in May 1950. Reference 9, p. 253, and Ref. 17 claim that deliveries begin to the 319th All Weather Fighter Squadron in June 1950. Reference 66, p. 1152, gives 16 June 1950 as the date when the Air Force accepts delivery of the first two F-94s.

F4D DOUGLAS SKYRAY (F-6)

- o Bat-winged interceptor designed for catapult operation from carriers
- o Designed for rapid rate of climb and high speeds

Milestone	Date	Event	Source
	1947	U.S. Navy proposal for a short-range, carrier-based interceptor fighter	18, p. 184
	1948	Basic design work begins	119, p 492; 126, p. 251
	16 December 1948 (Prototype start)	Two prototypes ordered	18; 29
	23 January 1951 (Prototype start)	First XF4D-1 prototype flown with XJ40-WE-6 and XJ40-WE-8	5, p. 167; 29; 18; 147a, B-152; 23, p. 237; 119;
	March 1953	Switch in engine--production F4D-1s to have J57-P-2	18
	5 June 1954	First production flight of F4D-1	18; 29; 5, p. 167; 147a, B-152
C	May 1955[22]	First delivery	
	August 1957	200th delivery	
	1958	Production stopped--420 F4D-1's had been built	34, p. 166
	September 1962	Redesignated F-6A	18

[22]Reference 34, p. 166, claims that deliveries began in 1954 but that the first operational squadron was not formed until 1956. Reference 18 gives 16 April 1956 as the date for first delivery to a Navy unit and Ref. 29 confirms April as the correct month.

F-100 NORTH AMERICAN SUPER SABRE

- o Evolved from the F-86 Sabre
- o Originally designated by North American as "Sabre 45" because of the aircraft's 45 deg of wing sweepback
- o North American spent one year on its own on development before working with the Air Force
- o Maximum speed of Mach 1.31, service ceiling of 55,700 ft, and unaided combat radius of 505 nautical miles
- o Over 2000 eventually purchased in all versions

Milestone	Date	Event	Source
	February 1949	F-100 begins to take shape as F-86 goes into production	130
	September 1950	ADO issued	10, p. 113
A	January 1951[23]	GOR/SOR issued	
	15 January 1951[24]	Unsolicited proposal--North American submits Sabre 45 design for consideration as supersonic day fighter	10, p. 113; 171
	October 1951 (Prototype start)	AF gives go ahead on Sabre 45	10, p. 113
	November 1951	Decision to procure two prototypes for a.new air-superiority fighter to combat the MIG-15 encountered in Korea	146a, p. 2-2; 142a, p. 56
	30 November 1951	Sabre 45 renamed F-100	10, p. 113
	3 January 1952[25]	Letter contract signed contract--two prototypes ordered from North American with deliveries in December 1953 and January.1954	10, p. 113; 146a, p. 2-2; 142a, p. 56
B	11 February 1952	Amendment No. 1 to letter contract calls for 23 F-100A aircraft to be delivered from December 1953 through July 1954; prototype deliveries advanced to June and July 1953	10, p. 113; 142a, p. 56
	11 March 1952	Amendment No. 4 authorizes tooling for production rate of 25 aircraft a month and peak rate of 175 a month	142a, p. 56
	26 August 1952	Amendment No. 7 specifies an additional 250 vehicles to be delivered from August 1954 to July 1955	146a, p. 2-2; 142a, p. 57
	December 1952	Definitive fixed-price incentive contract signed including all amendments	142a, p. 57
	24 April 1953	First prototype completed	171; 96

Milestone	Date	Event	Source
	25 May 1953	First flight of prototype (YF-100A)	147a, p. B-125; 83, p. 41; 10; 23; 146a, p. 2-2; 80; 142a, p. 59
	28 September 1953	First production F-100A completed	146a, p. 2-2; 171; 96
C	October 1953	First production acceptance	146a, p. 2-2
	14 October 1953	First flight, second prototype	10
	20 October 1953	First production F-100 rolls out	35, p. 15; 83
	25 October 1953[26]	F-100A sets an official world speed record of 755.149 mph	45
	29 October 1953	First flight of production F-100A	10, p. 114; 171
	February 1954	Follow-on letter contract for 230 C version aircraft	142a, p. 59
	June 1954	Definitive contract for 564 F-100C's	142a, p. 59
	29 September 1954[27]	F-100A becomes operational with Tactical Air Force's 479th Wing, first squadron delivery	109; 62; 142a, p. 59
	12 October 1954	F-100A accident--kills pilot George Welch	126, p. 251
	11 November 1954	F-100's grounded	142a, p. 59
	February 1955	AF lifts grounding	35, p. 15
	June 1955	First operationally equipped wing	142a, p. 60
	June 1955	Supplemental Agreement 43 provides $7 million cost increase for retrofit program following crash	142a, p. 60
	July 1955	200th delivery, all of them A versions	142a, p. 62
	September 1955	IOC	10, p. 115
	October 1959	Final delivery	8, p. 90

[23]Reference 10 dates GOR as 27 August 1951.

[24]Reference 146a states that North American initiated design efforts on the Sabre 45 in January, but that the unsolicited proposal was not made until May.

[25]References 9 and 29 claim that on 1 November 1951, the AF authorized two YF-100's and 100 F-100A's. No mention of this date or purchase of 100 aircraft is found elsewhere.

[26]References 23 and 96 note that speed record was on 29 October.

[27]Reference 10, p. 115, dates this as 27 September.

F-101 MCDONNELL VOODOO

- o Derivative of McDonnell F-88
- o Designed to escort very-high-flying, long-range bombers
- o Twin-jet supersonic fighter

Milestone	Date	Event	Source
	August 1945	Engineering Division at Wright Field issues industry-wide, preliminary design competition characteristics; 13 companies respond with 20 design proposals	
	May 1946	McDonnell receives a Phase I development contract covering work through mock-up of the XF-88	
	June 1946	Detail design work begins	17, p. 363
	August 1946	Mock-up inspection	
	June 1948	Plane completed and ready for engineering inspection	
	September 1948[28]	First flight of XF-88A	
	March 1949	Plane ready for shipment to Edwards; Phase I flight testing completed	
	April 1949	Phase II test program completed	
	August 1950	Experimental contract terminated because of cutback in funds	25, p. 347
A	January 1951	AF decision to seek new escort fighter design	10, p. 135; 146a, p. 2-5
	6 February 1951	GOR issued	10, p. 136; 146a, p. 2-5
	May 1951	McDonnell F-88 chosen in AF competition out of five proposals	10, p. 136; 146a, p. 205
B	October 1951	Production go-ahead; FY52 funds released to get F-88 into production; speed-up because of Korean War	10, p. 136
	November 1951	McDonnell initiates FSD and receives authorization for limited production	146a, p. 2-5
	30 November 1951	F-88 renamed F-101 Voodoo	10; 146a, p. 2-5
	15 January 1952[29]	Development contract--77 planes (no prototypes) ordered	
		McDonnell accepts initial letter contract offered by AF	10, p. 137

Milestone	Date	Event	Source
	May 1953	Construction of the first F-101 begun	9, p. 269
	29 September 1954[30]	First flight F-101A	17, p. 363; 25, p. 347; 5, p. 193; 146a, p. 2-5
	10 May 1956	First flight YRF-101A	17, p. 363
	October 1956	First production aircraft delivered[31]	146a, p. 2-5
	27 March 1957	First F-101B flown	10, p. 151
C	2 May 1957	First delivery of F-101A; enters operational service with TAC, 41st aircraft, first aircraft accepted for operational inventory	17, p. 363; 5, p. 193; 10, p. 140; 25, p. 347; 146a, p. 2-7
	May 1958	200th delivery	
	March 1961	Final delivery	8, p. 25

[28]Reference 10 disagrees; dates first flight 20 October 1948, as does Ref. 8.

[29]Reference 96 says McDonnell received a sizable production contract in January 1952 with appropriations totaling $20 million. Source 29 confirms that the January L/C was for 29 F-101A's, for design and development through mock-up. Reference 10 states that the contract was not finalized and signed by the AF until 11 June. Reference 29 reports that an order was placed for the 77 aircraft after the 29 September 1954 flight.

[30]Reference 105 dates first prototype flight as October; Ref. 17, p. 363, gives more specifically 20 October 1948.

[31]By implication, this is not an operational aircraft.

F-102 CONVAIR DELTA DAGGER

- o First delta-wing design accepted for operational use by the Air Force
- o First use of the Weapon System Concept
- o Grew out of Convair's experimental XF-92A, first true delta-wing powered aircraft to fly in the United States
- o First fighter to dispense with gun armament completely in favor of guided missiles and unguided rockets

Milestone	Date	Event	Source
	August 1945	Tentative interceptor requirements	
	September 1948	XF-92 first flight	
A	13 January 1949	ADO issued	10, p. 259; 146a, p. 2-9
	May 1949	Air Force presentations introducing weapon-system concept and discussing air defenseproblem	142a, p. 67
	April 1950	18 companies offer electronic and control system proposals	142a, p. 67
	18 June 1950[32]	Request for proposals for Project MX-1554 (operational date of 1954)	10, p. 159
	July 1950	Hughes named winner of electronic/ control system competition, first-year contract negotiated	142a, p. 67
	18 August 1950	GOR issued	
	31 August 1950	First development contract	
	January 1951	Bidding closed--six contractors had submitted nine proposals	10, p. 160; 142a, p. 69
	2 July 1951[33]	AF names three winners for Phase I development: Convair, Republic, Lockheed	10, p. 160; 146a, p. 2-10; 142a, p. 71
B	11 September 1951	Convair awarded L/C	10, p. 160; 146a, p. 2-10; 142a, p. 71
	24 November 1951	AF decides to expedite the 1954 Interceptor program--will follow Cook Craigie plan for early tooling, limited production at first, elimination of faults by test flights, and accelerated production thereafter	10, p. 161
	January 1952	Convair's letter contract increased to start a production-engineering and tooling program	142a, p. 72

Milestone	Date	Event	Source
	October 1952[34]	Production order to Convair	127
	18 November 1952	F-102A mock-up inspection	10, p. 162
	12 June 1953	Definitive contract for production of 42 aircraft to be delivered in 1954 and 1955; supersedes previous L/Cs	10, p. 163 142a, p. 76
	24 October 1953	YF-102 makes first flight	5, p. 154; 17, p. 169; 10, p. 163; 25, p. 287; 146a, p. 2-10; 147a, p. B-223
	2 November 1953	The first YF-102 is wrecked in emergency landing	10, p. 164
	11 January 1954	First flight of second YF-102	17, p. 169; 25, p. 287
	March 1954	AF gives Convair second production contract	10, p. 164
	4 November 1954	New GOR--Convair forced to meet new altitude and combat radius requirements	10, p. 164
	19 December 1954[35]	First flight of production configuration, YF-102A ("ideal body" configuration)	10, p. 165; 142a, p. 79
C	June 1955[36]	F-102A production models begin delivery; lightweight body configuration, designed as test-flight vehicles, 23 in all	5, p. 154; 142a, p. 80
	24 June 1955	First flight production F-102A	10, p. 165; 17, p. 169
	March 1956	Last delivery of initial 23 aircraft	142a, p. 80
	June 1956[37]	First squadron becomes operational	29; 5, p. 154
	January 1957	200th delivery	

[32]Reference 142a dates request for airframe proposals in September 1950.

[33]Reference 10 states that soon after the three winners were announced, the AF decided against letting three manufacturers work through Phase I. Lockheed was canceled entirely and the letter contract of September declared Convair the winner--although the Republic XF-103 development was still authorized.

[34]Reference 10 states that a definitive contract for production was not awarded until 12 June 1953.

[35]Reference 24 dates YF-102A flight at 20 December as does Ref. 17, p. 169; Ref. 5, p. 154; and Ref. 8, p. 117.

[36]Reference 146a, p. 2-10, dates first production article delivery in May 1955.

[37]Reference 10 says the F-102A enters service with the Air Defense Command's 327th Fighter Interceptor Squadron (FIS) at George AFB in April 1956.

F-104 LOCKHEED STARFIGHTER

- o First operational interceptor capable of sustained speeds above Mach 2
- o Developed from Lockheed F-90
- o First aircraft in history to hold world records for both absolute speed and altitude (1,404.19 mph and 91,249 ft) simultaneously

Milestone	Date	Event	Source
	May 1962	Lockheed presents WADC with design L-227, but it is rejected in midst of internal Air Force dispute between those favoring heavier complex planes and those favoring simpler lightweight planes that could be produced in greater quantity; L-227 was a heavy plane	142a, p. 82
	November 1952	Lockheed submits unsolicited proposal for new air superiority fighter, L-246	9, p. 278; 10, p. 175; 17, p. 343; 146a, p. 2-13; 142a, p. 84
A	12 December 1952	GOR for lightweight air superiority day fighter to replace TAC's F-100's in 1956 (new engine technology makes possible high performance in lightweight aircraft)	10, p. 175; 146a, p. 2-13
	January 1953	Competitive bidding by Republic, North American, and Lockheed. Lockheed selected	10, p. 175; 146a, p. 2-13
	11 March 1953 (Prototype start)	Letter contract given to Lockheed for two XF-104's and one year of flight testing	9, p. 278; 10, p. 176; 17, p. 343; 142a, p. 84
	30 April 1953	Mock-up inspection	10,p. 176
	November 1953	Definitive contract signed with Lockheed for delivery of two prototypes in March 1955	142a, p. 85
	7 February 1954[38]	First flight XF-104	17; 19; 5; 27; 29; 146a, p. 2-13; 8; 147a, p. B-231; 142a, p. 85
	April 1954	Production go-ahead	146a, p. 2-13
B	July 1954	AF decides to purchase 17 aircraft for development tests	10, p. 176; 146a, p. 2-14
	October 1954	First production contract for 17 F-104's--initial procurement with deliveries running from January to October 1956, engine switched to J-79 because of	10, p. 176; 142a, p. 88

Milestone	Date	Event	Source
		inadequate performance of the J-65 in the prototype tests	
	March 1955	Phase II prototype testing complete	142a, p. 86
	October 1955	New letter contract to Lockheed exceeds $100,000,000	38, p. 12
	17 February 1956	First flight production aircraft F-104A (early flight-test program slowed, in part, because of problems with the J-79 engine)	10, p. 177; 5, p. 187; 26, p. 372; 147a, p. B-231; 142a, p. 88
	June 1956	J-79 passes its 150-hour test	142a, p. 88
	August 1956	Phase II flight tests complete on F-104A	142a, p. 89
	January 1957	First production acceptance of F-104B trainer aircraft.	10, p. 181
C	26 January 1958[39]	Becomes operational with the Air Defense Command, F-104A enters operational service	10, p. 178; 9, p. 278; 29; 5, p. 187; 17, p. 343; 26, p. 372; 147a, p. B-231
	December 1958	200th delivery	
	1964	Final delivery	8

[38]Reference 10, p. 176, gives 28 February 1954.

[39]Reference 146a, p. 2-14, cites August 1957 as the date of the first production article delivery.

F-105 REPUBLIC THUNDERCHIEF

- o Single-seat, single-engine aircraft, meant for a nuclear role but also having an air-to-air capability
- o Designed from the start as a Tactical Air Force fighter-bomber to succeed the F-84F

Milestone	Date	Event	Source
	1951	Design work begins	26, p. 339
A	March 1952	Requirement issued	137, p. 46
	April 1952	Republic submits a proposal for their model AP-63	10, p. 191; 146a, p. 2-17
	May 1952	Air Staff, upon recommendation of the Aircraft & Weapon Board, endorses F-105 development	10, p. 191; 146a, p. 2-17
B	September 1952[40]	Letter contract for 199 aircraft--first to be operationally ready by 1955	10, p. 191; 146a, p. 2-17
	10 September 1952	GOR issued	
	March 1953	Letter contract reduced to 37 F-105's and nine RF-105's	10, p. 191
	October 1953	Mock-up inspection	10, p. 191
	December 1953	AF suspends procurement because of Republic's excessive delays	10, p. 191
	February 1954	Procurement reinstated but order reduced to 15	10, p. 191
	September 1954	AF reduces order to three because of further delays	10, p. 191
	October 1954	AF increases order to six	10, p. 191
	1 December 1954	Amended GOR 49 called for inflight refueling capability, a more complex fire control system, improved performance, installation of J-75 engine	10, p. 192
	22 October 1955	First flight of YF-105A (with interim J-57 engine)	26; 5, p. 213; 17, p. 469; 10, p. 192; 72, p. 7; 146a, p. 2-17; 147a, p. B-239
	28 January 1956	Second YF-105A makes first flight	10, p. 192
	March 1956	AF releases $10 million of FY57 funds for the acquisition of 65 F-105B's and 17 RF-105's, production authorized	10, p. 192; 146a, p. 2-17

Milestone	Date	Event	Source
	26 May 1956[41]	First YF-105B makes first flight (first model with J-75 engine); damaged on landing--flight-test program delayed	10, p. 192; 147a, p. B-239
	24 May 1957	First F-105B flown	17, p. 470
	22 November 1957	Further revision to GOR 49	10, p. 193
C	27 May 1958	First acceptance of production aircraft, F-105B	5, p. 213; 113, p. 8; 17, p. 470; 10, p. 193; 76, p. 31; 146a, p. 2-17
	August 1958	Enters operational service	10, p. 193
	January 1959[42]	F-105 declared operational	17, p. 469
	April 1961	200th delivery	
	1965	Final delivery	8, p. 94

[40]Letter contract covers preproduced engineering, tooling design, fabrication, and material procurement.

[41]Reference 26 gives 22 May 1956 as first F-105B flight.

[42]Reference 10 disagrees; as late as March 1960, none of TAC's F-105's were operationally ready

F-106 CONVAIR DELTA DART

- o Grew out of Convair's delta-wing XF-92
- o Developed during 1955 under the designation of F-102B
- o Originated as part of 1954 Ultimate Interceptor Program
- o All-weather jet interceptor

Milestone	Date	Event	Source
	13 January 1949	ADO--1954 Ultimate Interceptor	10, p. 207
	September 1951	Convair's entry selected, design work started on F-102	10, p. 207; 146a, p. 2-20
	24 November 1951	AF production decision, F-102A	10, p. 207
	December 1951	AF authorizes two-step production F-102A and B with same airframe	10, p. 207
B	November 1955[43]	Convair awarded new production contracts: 562 F-102A's and 17 F-102B's (brings A total up to 749)	10, p. 208; 146a, p. 2-20
	18 April 1956	F-102B production contract finalized--17 F-102B's earmarked for testing	10, p. 208; 146a, p. 2-20
	17 June 1956	F-102B redesignated F-106	10, p. 209; 146a, p. 2-20
	28 September 1956	AF issues System Development Directive outlining requirements	10, p. 209
	December 1956	First production article delivered, development lot	146a, p. 2-20
	26 December 1956	First F-106A prototype flight	10, p. 209; 5, p. 155; 95, p. 6; 146a, p. 2-20; 147a, p. B-248
	April 1957	AF conditionally accepts several F-106's F-106B ordered into parallel production with F-106A	10, p. 210 25, p. 286
	June 1957[44]	Quantity production begins	9, p. 287
	19 June 1957	GOR--28 September 1956 requirements finalized	10, p. 210
	9 April 1958[45]	F-106B makes first flight	17, p. 172; 10, p. 219; 25; 3a
	June 1958[46]	Initial delivery of production aircraft	
C	May 1959	F-106A enters operational service	10, p. 212

Milestone	Date	Event	Source
	October 1959	IOC	10, p. 212
	April 1960	200th delivery	

[43]First distinguishable event identified with the F-102B/F-106, although actual development work can be traced to early phases of F-102A program.

[44]Reference 5 gives August.

[45]Reference 5 gives April 19.

[46]First acceptance after initial development lot of 17 airplanes. Actual operational service was delayed until 1959. (For the operational service date: Reference 10 says May; Refs. 3a, 8, 17, 29, and 25 say July.)

F4H MCDONNELL PHANTOM II

- o Designed as a twin-engined replacement for the Navy's F3H all-weather fighter
- o Originally designated AH-1

Milestone	Date	Event	Source
	Mid-1953	Specification for a new carrier-based aircraft is drawn up	84, p. 213
	September 1953	McDonnell presents Navy with unsolicited proposal	29, p. 424
	1954	Construction of a full-scale mock-up of F3H-G with J65 engines	84; 6, p.11
A	18 October 1954[47]	Letter of intent for design work only (no firm requirement) on AH-1 ground attack types with J-79 engines	29; 27, p.341; 135a
	April 1955	Six months' work scrapped--new specification details necessitate a major redesign	84; 6
B	26 May 1955[48]	Development authorized; redesignated as XF4H-1 missile fighter	29; 27; 6
	July 1955	Agreement reached on detail specification for F4H-1	6; 135a
	27 May 1958	First flight of XF4H-1	29; 27; 84; 135a 147a, p. B-136; 134a
	December 1958[49]	McDonnell receives order for 375 F-4's from the U.S. Navy	84; 135a
C	December 1960[50]	First operational delivery	
	July 1961	IOC	134a
	1962	F4H-1 redesignated F-4A	29
	March 1962	First F-4 accepted by USAF	34, p. 166
	October 1962[51]	200th delivery	
	1978	5,000th Phantom rolled off assembly line--operated by 11 countries--served in Vietnam War with USAF, Navy, and Marine Corps	84
		Still in production in 1979	34

[47]Reference 84 gives November 1954 as the date of the letter of intent; Ref. 134a gives August 1954 as the date of DSARC II equivalent; Ref. 134a calls October 1954 the date of FSD contract.

[48]The complete system with avionics and missiles was included in prototypes.

[49]Reference 8 claims that in December 1958 BuAer awarded a limited contract for 23 development Phantom II's plus 24 production aircraft.

[50]Considerable confusion exists in the records on early deliveries. The initial production run of 23 aircraft (in lots of 7, 11, and 5) were clearly F-4A, with the last five incorporating the larger radar dish diameter. Some sources show the second batch of 24 to be F-4A, while other sources call those airplanes F-4B. Regardless of designation, all sources except 84 (including personal recollections of the McDonnell program manager) indicate that the lot starting with unit #24 were the first airplanes delivered to the Navy for operational use. Initial acceptance date of that 24th airplane is also a matter of some uncertainty. Factory records show the first item of that lot to be delivered in December 1960. References 27 and 135a also give December 1960 as the date that the first production Phantom II was delivered to a U.S. Navy Squadron, VF-101. However, Ref. 6, p. 26, gives February 1961 as date of delivery for inventory. Reference 134a gives June 1959, the date of #14 delivery, as the date of first production delivery.

[51]This assumes that all F-4A's were development items.

F-111 GENERAL DYNAMICS

- o World's first variable-geometry aircraft designed as an operational plane
- o First tactical fighter designed from the start to meet the requirements of two major fighting services

Milestone	Date	Event	Source
	27 March 1958	GOR issued	10, p. 223
	29 March 1959	GOR canceled--AF feels vertical takeoff not yet possible	10, p. 223
A	5 February 1960	System Development Requirement 17 incorporated most of the original requirements except vertical takeoff	10, p. 223; 146a, p. 2-23
	March 1960	NASA reports feasibility of variable wing sweep	1, p. 179
	April 1960	ARDC/TAC joint agreement on development program	1
	14 July 1960	SOR 183 issued	161
	October 1960	AF request for proposals prepared but deferred by Eisenhower	10, p. 224; 3, p. 451
	February 1961	McNamara says TFX should be developed to meet needs of AF and Navy	1, p. 179
	7 June 1961	McNamara concludes TFX should fulfill Navy and AF requirements; directs AF to begin development	1, p. 179; 155
	September 1961	Official program go-ahead for joint Navy-AF program	
	29 September 1961[52]	New request for proposals	10, p. 225; 146a, p. 2-23
	December 1961	TFX designated F-111A	10, p. 225
	19 January 1962[53]	Source Selection Board votes unanimously to recommend Boeing as winner of TFX contract	1, p. 180; 136a; 146a, p. 2-23
	1 February 1962[54]	$1 million L/C to Boeing and General Dynamics for more design data	155; 151; 146a, p. 2-23
	11 September 1962	Boeing and General Dynamics submit their fourth and final proposals to the Source Selection Board	1, p. 180; 146a, p. 2-23
	2 and 8 November 1962	Source Selection Board and AF Council recommend Boeing	1, p. 181; 135a 146a, p. 2-23;

Milestone	Date	Event	Source
	24 November 1962	General Dynamics design selected	29, p. 280; 17; 1, p. 181; 9, p. 297; 146a, p. 2-23; 151
B	21 December 1962	R&D letter contract issued to General Dynamics for 18 F-111A's and five F-111B's	155; 161; 151; 136a; 146a, p. 2-24
	1 May 1964[55]	Definitized contract for 23 development aircraft	10, p. 226
	15 October 1964	Roll-out of the first F-111A	17; 135a; 136a; 147a, p. B-256
	21 December 1964	First prototype flight	9, p. 297; 161; 10, p. 226; 135a; 26, p. 346; 136a; 146a, p. 2-24; 147a, p. B-256
	6 January 1965	Second prototype flight	17
	12 April 1965	Production L/C to General Dynamics	29, p. 281; 19; 10, p. 227; 161; 146a, p. 2-24; 17
	18 May 1965	First F-111B flies	19; 135a; 147a, p. B-256
	July 1966	An F-111 reached maximum design speed of Mach 2.5 for the first time	
	12 February 1967	First flight F-111A production aircraft	10, p. 278; 153, p. xvi
C	April 1967[56]	First production acceptance, F-111A	146a, p. 2-24; 136a
	16 October 1967	First delivery of F-111A production aircraft to operational wing	37, p. 119; 17, p. 296; 10, p. 229; 9, p. 300; 29, p. 281
	25 March 1968	F-111A's enter combat over Vietnam	29, p. 281
	28 April 1968	IOC	10, p. 229; 161
	April 1968[57]	Cancellation of F-111B	18, p. 252
	December 1969	200th delivery	

[52]Reference 1, p. 180, dates RFP as 1 October.

[53]The Source Selection Board and AF Council recommend Boeing three more times in 1962: 14 and 24 May, 20 and 21 June, and 2 and 8 November--Ref. 1, pp. 180-181.

[54]Reference 17, p. 295, report that General Dynamics and Boeing are selected as finalists in January 1962.

[55]Reference 155 says that the contract is approved May 22 and distributed on May 27.

[56]Reference 7 claims first service delivery occurs in June 1967. Reference 37, p. 119, gives July 1967 as the initial delivery date of an F-111A to a training unit.

[57]Secretary of the AF Harold Brown stopped work on the F-111B after the House Armed Services Committee disapproved an appropriation for further development and procurement of the Navy model.

F-14 GRUMMAN TOMCAT

- o All-weather, carrier-based weapon system capable of performing air-to-air combat and air-to-surface attack missions
- o Twin-engine, two-place variable sweep wing, supersonic fighter

Milestone	Date	Event	Source
	September 1966	Preliminary studies	170
	October 1967	Grumman submits unsolicited proposal to Navy	135
A	30 November 1967	Navy Fighter Study initiated to determine Navy tactical fighter requirements and the feasibility of the Grumman design	139, p. 10
	March 1968	Navy Fighter Study results published recommending Navy proceed with contract definition	
	April 1968	F-111B cancelled; however, use of avionics and engines that had been developed under the F-111B program enabled development and production to proceed rapidly	18, p. 252; 145, pp. 6-7
	21 June 1968[58]	Requests for proposals to five manufacturers	159; 26, p. 355
	17 July 1968[59]	USN awards contracts to five manufacturers to initiate contract definition phase (CDP) of TFX program--$3 million each to five contractors	159; 26, p.355
	1 October 1968	Due date for proposals	26
	17 December 1968	Source Selection authority announces Grumman and McDonnell Douglas as finalists--proposals to be modified and resubmitted in January 1969	26; 134a
	15 January 1969	Grumman Model 303 announced winner	18, p. 252; 134b; 9, p. 341; 135a; 147a, p. B-159
B	3 February 1969[60]	Grumman awarded engineering development contract for six F-14A's--contract signed	159; 135a; 136a
	May 1969	Airframe mock-up	159
	21 December 1970[61]	First flight of development aircraft	9, p. 341; 136a; 18, p. 252; 135a; 159; 147a, p. B-159
	30 December 1970	Second flight--hydraulic system fails and plane is lost, causing testing delays	159; 18, p. 252

Milestone	Date	Event	Source
	24 May 1971	Flight testing resumes with second plane	9, p. 341; 18, p. 252
	June 1971	DSARC III approves F-14A procurement	169a
C	May 1972[62]	Production deliveries begin	135; 135a; 16; 136a
	12 October 1972[63]	F-14A delivered to Fleet	9, p. 341; 27, p. 309; 8
	July 1976	200th delivery	

[58]References 135 and 135a date RFP release as December 1967.

[59]Reference 170 gives June as CDP contract award date.

[60]Reference 9, p. 341, says that six planes were ordered for the development program and six more as preproduction F-14A's.

[61]Reference 159 notes flight occurred one month ahead of schedule.

[62]Reference 144 dates first delivery of F-14A one month later, in June. Reference 18 gives "late 1972"; Ref. 147a gives April 1972.

[63]Squadron delivery occurs in early 1973--Ref. 14, p. 171. Reference 135 gives July 1974 as F-14A fleet deployment date.

F-15 MCDONNELL DOUGLAS EAGLE

- o Originally named F-X
- o Tactical fighter aircraft designed to maintain air superiority through air-to-air combat with nonnuclear weapons
- o Two Pratt and Whitney (P&W) F100-PW-100 turbofans with 25,000 lb thrust each

Milestone	Date	Event	Source
A	April 1965	Department of the AF directs AFSC to initiate actions to develop and acquire a new tactical support aircraft weapon system	151, p. 3
	November 1965	USAF directs the conceptual investigation of a new tactical fighter	146a, p. 2-28; 136a
	April 1966[1]	F-X study awarded to three firms	170
	12 August 1966	F-X System Program Office established	
	September 1966	A Preliminary F-X Concept Formulation Package presented to the ASD Council	
	June 1967	Concept Formulation Package (CFP)	151, p. 3
	June 1968	Requirement issued	137, p. 52
	8 August 1968	RFP released for F-15 attack radar	
	9 August 1968	Revised CFP and a Technical Development Plan (TDP)	151, p. 3
	27 August 1968	AF awards initial development contracts for the F-15 engine to Pratt and Whitney and GE	
	16 September 1968	DoD Development Concept Paper (DCP) outlines guidelines for F-15 program	151, p. 3
	28 September 1968	DCP approved--AF authorized to proceed with contract definition	151, p. 3
	30 September 1968	RFP released to eight manufacturers, four respond	151, p. 3
	24 October 1968	F-X redesignated F-15A	
	19 November 1968	F-15 contract proposal evaluation begins	
	31 December 1968	AF announces award of definition contracts to North American, McDonnell Douglas, and Fairchild	151, p. 4
	13 February 1969	Pratt and Whitney and GE receive competitive contracts to furnish data on engine-airframe compatibility for the F-15 designs	

Milestone	Date	Event	Source
	June 1969	System contract definition reports and proposals for development received from three manufacturers	151
	December 1969	DSARC II gives approval for engineering development	169a
	23 December 1969	McDonnell Douglas named winner in development competition, given development contract	17, p. 370; 136a; 147a, p. B-170; 146a, p. 2-30; 135a
B	1 January 1970	F-15 program enters full-scale development	151; 146a, p. 2-28; 136a; 134b, p. 31
	March 1970	Pratt and Whitney selected for engine contract	147a, p. B-170
	April 1971	Critical design review	
	June 1972	First development aircraft rolled out	146a, p. 2-28; 136a
	27 July 1972	First F-15A prototype flight	9, p. 344; 135; 27, p. 343; 135a; 146a, p. 2-28; 147a, p. B-170
	October 1972	Long lead production funding released for first wing of aircraft	146a, p. 2-28; 169a
	February 1973	DSARC production approval	135; 135a; 169a
	1 March 1973[2]	Production go-ahead for 30 operational aircraft, full production funding	27, p. 343; 146a, p. 2-28
	July 1973	First flight of F-15B (TF-15A)	147a, p. B-170
C	14 November 1974	Squadron delivery (inventory); first production delivery	147a, p. 2-28; 136a; 8, p. 30; 27; 13; 146a, p. 2-28; 135a;
	September 1975	IOC	136a; 134b, p. 31
	July 1977	200th delivery	

[1] References 135a and 147a, page B-170, date the study awards in July 1966.

[2] Reference 39, p. 19, confirms the number 30 as the initial order. Reference 9, p. 344, claims an order for 20 planes was approved in the spring of 1973.

F-16A GENERAL DYNAMICS FIGHTING FALCON

- o Multi-role, lightweight, supersonic fighter, started as Light-Weight Fighter (LWF) program
- o Uses one 23,840 lb thrust P&W F100-200 turbofan or one 29,000 lb thrust General Electric F110-GE-100

Milestone	Date	Event	Source
	1965-1970	Industry supported design studies	
	June 1970	President's Blue Ribbon Panel Report issued; recommended abandoning Total Package Procurement and more use of competitive prototyping	136
A	September 1971[3]	Lightweight Fighter Program announced	170; 135a
	6 January 1972[4]	RFP issued for Lightweight Fighter	
	18 February 1972[5]	Five aircraft manufacturers enter design competition: General Dynamics, Northrop, Boeing, LTV Aerospace, and Lockheed	9, p. 347
	1 April 1972[6] (Prototype start)	AF awards LWF prototype contracts to General Dynamics and Northrop	136; 146a, p. 2-36; 135a; 147a, p. B-178; 136a
	13 December 1973	First YF-16 prototype rolled out	27
	8 January 1974	YF-16 arrives at Edwards AFB	27
	20 January 1974	Unscheduled first flight--pilot takes off during taxi tests	27; 9, p.347
	2 February 1974	Official first flight of General Dynamics YF-16	27; 135; 147a, p. B-178
	Spring 1974	Iran, Belgium, Netherlands, Denmark, Norway interested in lightweight fighter; in June, a consortium (without Iran) is formed to find a replacement for the F-104	
	9 May 1974	Second YF-16 prototype's first flight	9
	9 June 1974	Northrop's YF-17 makes first flight	136
	11 July 1974	Written U.S. commitment setting source selection by 1 January	165
	7 August 1974	General Dynamics and Northrop awarded "transition" contracts of $4 million to help them prepare full-scale development proposals	

Milestone	Date	Event	Source
	7 September 1974	USAF issues formal proposal instructions for full-scale development of an air combat fighter	
	November/December 1974	Proposals received and evaluated	
B	13 January 1975	General Dynamics YF-16 wins; full-scale development contracts awarded	74, p. 75; 27; 9; 97; 37, p. 118; 86; 136a; 147a, p. B-178; 135a; 146a, p. 2-36; 134a
	March 1975	DSARC II approves FSD	169a; 134b, p. 31
	7 June 1975	European Consortium chooses F-16	27; 165
	27 February 1976	Required operational capability (ROC) TAC 303-76 published	
	20 October 1976	First of eight full-scale development F-16s rolled out	136; 77, p.19; 136a
	8 December 1976	First flight full-scale development F-16A	136; 135a; 134a; 146a, p. 2-36
	January 1977	Program approved for release of long-lead funds for first production lot, DSARC IIIA	135a, 169a; 146a, p. 2-37
	13 October 1977[7]	DepSecDef authorizes full production	166, p. i; 135a
	7 August 1978	First flight production aircraft	111, p. 159; 147a, p. B-178
C	17 August 1978	First production F-16 accepted by AF, OT&E aircraft delivered	147a, p. B-178, 135a; 146a, p. 2-37; 111; 134a
	6 January 1979	First operational F-16 delivered to TAC, activation of first F-16 squadron	37, p. 118; 135a; 147a, p. B-178

[3]Reference 146a cites August 1971 as the date of Lightweight Fighter Program authorization by SecDef and the date that ASD established the Prototype Program office.

[4]RFQ, January 1972; RFP submitted to USAF in February 1972 (Ref. 170).

[5]Reference 27, p. 299, gives 28 February.

[6]Reference 27 gives April 13 as contract award date. Reference 132, p. 71, does not give an exact date but rather says, "Early in 1972, General Dynamics was awarded a $38 million contract to develop and produce two YF-16s and Northrop $39 million for two YF-17s."

[7]Reference 146a dates DSARC IIIB full-production go-ahead in December 1977.

F-18 MCDONNELL DOUGLAS HORNET

- o Single-seat, carrier-based naval strike fighter
- o Designed to replace F-4 fighter and A-7 attack aircraft and to complement the F-14
- o Two GE F404-GE-400 turbofans, 16,083 lb thrust each

Milestone	Date	Event	Source
	1971	U.S. Navy becomes concerned at cost of F-14	8, p. 32
A	September 1971	USAF announces Lightweight Fighter Program	See F-16
	April 1972	Lightweight fighter prototype program (YF-16, YF-17) started	See F-16 147a, p. B-185
	1973	U.S. Navy studies low-cost versions and compares them with navalized F-15 versions and improved F-4's	8, p. 32
	April 1974	DoD accepts proposal from the U.S. Navy to study a low-cost lightweight multi-mission fighter, VFAX	27, p. 346; 136a
	June 1974	USN approaches manufacturers to submit critiques and concepts; USN has responses from six manufacturers	27; 86
	9 June 1974	First flight of YF-17	9, p. 350
	28 August 1974	Congress terminates VFAX concept; changed to NACF program--Navy issues operational requirement for a new multi-mission aircraft	27; 70, p.25
	Fall 1974	Navy is directed to limit its competition to YF-16 (General Dynamics) and YF-17 (Northrop) derivatives	70
	12 October 1974	Requests for quotation sent out to industry	149, p. 6
	October 1974	Northrop teamed with McDonnell	170
	December 1974	McDonnell and LTV respond with preliminary technical proposals	149, p. 6
	December-January 1975	McDonnell and LTV furnish additional data	149, p. 6
	15-16 January 1975	Navy Source Selection officials meet and advise LTV and McDonnell on the shortcomings of their proposals	149, p. 6
	January-February-March 1975	Contractors submit revised proposals	149, p. 6

Milestone	Date	Event	Source
	28 April 1975	Source Selection Authority selects McDonnell Model 267	149, p. 6
	2 May 1975	Public announcement of selection; initial short-term contract of $4.4 million to McDonnell Douglas/Northrop and $2.2 to GE	27, p. 346; 86; 70; 135a
	9 May 1975	LTV files formal bid of protest with Government Accounting Office (GAO)	149, p. 2
	1 October 1975	GAO and House of Representatives uphold procurement decision; reject LTV's protest	94; 149, p. 3
	21 November 1975	Full-scale development contract to General Electric for F404-GE-400 engine	70; 135a
B	December 1975	DSARC II, start of engineering development	135a; 169a; 134a
	22 January 1976[8]	Full-scale development contract with McDonnell Douglas for 11 R&D aircraft	70, p. 25; 135a; 1; 147a, p. B-185; 136a
	September 1978	F-18 rolled out	70
	18 November 1978	First flight	71, p. 19; 93; 160a; 147a, p. B-185; 135a; 134a; 136a
	July 1979	Five aircraft delivered to Patuxent Naval Air Test Center	87, p. 45
C	May 1980	First pilot production delivery	71, p. 19; 135a; 147a, p. B-185; 134a
	June 1981	Full-scale production approved, DSARC III	135a; 169a
	December 1982	DSARC IIIB, continued production approved	169a
	March 1983	IOC	134a; 136a

[8]Reference 27 gives 28 January as contract date; Ref. 149, p. 2, gives 26 January.

A-3D DOUGLAS SKYWARRIOR

- o First swept-wing jet attack bomber produced for the Navy
- o Capable of carrying heavy loads of all types of weapons

Milestone	Date	Event	Source
	1947	Discussions between Navy and Douglas; Bureau of Aeronautics outlines requirements for a bomber to operate from a large carrier	18, p. 186; 120
	1949	Douglas completes design	19; 18
	31 March 1949[9] (Prototype start)	Two prototypes (XA3D-1) ordered	18, p. 186; 19
	28 October 1952	First prototype flight (J40 engine)	79; 18; 23, p. 239; 120; 5, p. 168
	?	Production orders placed	5, p. 168
	16 September 1953	Airplane reequipped with Pratt and Whitney J57-P-6 engine--first flight of this production version	23; 5; 18; 120; 147a, p. B-2
C	January 1955	First acceptance from production batch	147a, p. B-2
	31 March 1956[10]	Enters operational service	18, p. 187; 148
	June 1960	200th delivery	

[9]There is no record of a subsequent, separate decision to initiate full-scale development.

[10]April 1956 is given as the date the A3D-1 "begins to reach the Fleet" in Ref. 32, p. 18.

A-4 MCDONNELL SKYHAWK

- Simple, lightweight design
- Named "Heinemann's Hotrod"
- Originally designated A4D-1

Milestone	Date	Event	Source
	1951	U.S. Navy requirement for a low-cost attack aircraft	118
B	21 June 1952	Initial development contract given Douglas for prototypes and preproduction aircraft	18, p. 305; 135a
		Navy inspects mock-up and places orders	19
	September 1952	Prototype construction begins	27, p. 352
	22 June 1954	First prototype flight, XA4D-1	19; 118; 27; 135a; 147a, p. B-10
	14 August 1954	First flight, A-4A preproduction aircraft with J65-W-2 engine	18, p. 306; 19 135a
C	August 1955[11]	First delivery--production batch	
	26 March 1956	First flight A4D-2 (A-4B)	26, p. 402
	26 October 1956[12]	Deliveries begin to Navy Attack Squadron VA-72--enters operational service	18, p. 306; 118; 19; 135
	December 1957	200th delivery	
	1977	Deliveries near 3,000	8, p. 84

[11]Reference 147a, p. B-10, lists first production version delivery of A-4A in August 1954; Ref. 135a lists October 1956 as the date of initial production deliveries.

[12]Reference 148 lists 27 September 1956 as "squadron delivery" date.

A-5 NORTH AMERICAN VIGILANTE

- o Attack bomber designed to carry nuclear or conventional weapons over a range of several hundred miles at high altitudes, with an over-target speed of Mach 2
- o A3J designation changed to A-5 in 1962

Milestone	Date	Event	Source
	1955	Navy requirement for a high-performance attack aircraft with all-weather capability	9; 18, p. 352
B	29 June 1956[13]	Letter contract to North American	19; 18
	29 August 1956[14]	First development order	29, p. 361
		Two prototypes ordered	18; 19
	31 August 1958[15]	First prototype flight	147a, p. B-18
	January 1959	Large follow-on production contract awarded North American	26; 29, P. 361
C	February 1960	First production acceptance	18, p. 353; 19
	June 1961	Enters squadron service; VAH-7 is first operational unit to receive A-5 (did not reach 200th delivery)	29, p. 361; 18; 11

[13]Reference 29, p. 361, says a "letter of intent" was issued in June 1956. Actual contract followed on 29 August.

[14]Reference 26, p. 412, dates prototype contract as September 1956. This contract apparently included provision for full-scale engineering and an initial production commitment because production deliveries began 18 months after first "prototype" flight.

[15]Three sources agree on the date but differ on designation: Ref. 26--YA-5A; Ref. 19--YA3J-1; and Ref. 11--XA3J-1.

A-6 GRUMMAN INTRUDER

- o World's first fully all-weather/night attack aircraft capable of detecting and identifying tactical or strategic targets and delivering conventional or nuclear weapons on them under zero-visibility conditions

Milestone	Date	Event	Source
	1956	Requirement for a low-level, long-range strike aircraft for U.S. Navy service	18
A	May 1957	Competition announced; eight manufacturers begin study	27, p. 305; 29, p. 361
B	31 December 1957[16]	Source selection--Grumman G-128 proposal chosen out of 11 submitted	18; 27; 11; 134a
	26 March 1959[17]	First contract: initial order for eight development aircraft	148; 18; 26, p. 353; 29
	19 April 1960	First flight, development aircraft	29, p. 361; 26, p. 353; 11; 135; 148; 147a, p. B-27; 135a; 134a
	April 1962	First acceptance from production batch	
	Late 1962	First 10 production aircraft are flying	18
C	1 February 1963[18]	First squadron delivery, first production delivery, IOC	18; 26; 11; 134a; 148; 3a; 135a
	February 1967	200th delivery	
	1975	Final delivery	8, p. 71

[16]This assumes that FSD started immediately after source selection although the contract was not signed until 15 months later. This assumption allows 27 months to first flight.

[17]Reference 26, p. 354, notes that the A-6A was developed under the first cost-plus incentive contract placed by the U.S. Navy. Further, Ref. 26 states that an additional contract followed in March 1960 and the two contracts together covered the development of eight aircraft. Ref. 29 confirms that first contract was for only four aircraft; Ref. 134a dates DSARC II equivalent in December 1957 but dates FSD award in February 1958.

[18]Reference 29, p. 361, says A-6 did not reach operational service until 1964.

A-7 VOUGHT CORSAIR II

- o Attack aircraft developed by the U.S. Navy for carrier operation and subsequently flown by both the U.S. Navy and Air Force
- o Adopted by the AF virtually off the shelf, a precedent set by the McDonnell F-4

Milestone	Date	Event	Source
	1960	Bureau of Naval Weapons (BUWEPS) study group recommends development of a new Navy attack a/c to take advantage of new turbofan jet engine, TF-30	138, p. 7
	1960-1962	Discussions on visual attack light (VAL) a/c continue	138, p. 7
	November 1962	Chief of Naval Operations asks BUWEPS for its VAL recommendations	138, p. 7
A	December 1962	Sea Based Air Strike Study Group formed	138, p. 8
	Early 1963	Group briefs a meeting of eight aircraft contractors on purpose of study--solicit help of entire industry	138, p. 8
	April 1963	Group continues to meet with contractors to study plan	138, p. 9
	May 1963	Navy Sea Based Strike Study recommends a follow-on visual attack carrier aircraft to replace the A-4	140; 135a; 147a, p. B-46
	17 May 1963[19]	USN initiates design competition for a light attack aircraft to replace the Douglas A-4 Skyhawk, SOR W11-26 drafted by Navy	18; 151
	24 May 1963	Synopsis of A-7 requirements transmitted to industry	140
	29 June 1963	Formal Request for Quotation distributed to industry	140; 147a, p. B-46
	12 August 1963	North American, Douglas, LTV submit proposals	138
	4 November 1963	Navy evaluates proposals	140
	13 November 1963	Secretary of the Navy approves LTV selection as prime contractor	140
	11 February 1964	Ling-Temco-Vought named winner	27; 18; 134a; 29, p. 362
B	19 March 1964	Contract awarded LTV--seven A-7A's for flight testing and first 35 production aircraft	27; 18; 151; 138; 135a; 134a; 147a, p. B-46

Milestone	Date	Event	Source
	September 1965	Second production contract for 140 additional F-7A's	18
	27 September 1965[20]	First A-7A flies	27; 18; 65; 147a, B-46; 135a; 134a
C	March 1966	First delivery from production batch	
	13-15 September 1966[21]	U.S. Naval Air Test Center receives first four aircraft	27
	14 October 1966	Delivery to user squadrons begins	27
	1 February 1967	VA-147 commissioned as the first A-7A tactical squadron, IOC	18; 134a
	January 1968	200th delivery	

[19]Reference 138 dates the Specific Operational Requirement W11-26 as 17 May and says the RFP was not distributed until the following month.

[20]Reference 29, p. 362, dates first flight as 25 September 1965.

[21]Reference 18, p. 293, states that September and October mark delivery dates to first two "training units.

A-7D VOUGHT

Milestone	Date	Event	Source
B	28 October 1966	Full production contract award	134a
	22 January 1968	First A-7D production rollout	134a
	26 September 1968	First A-7D flies with Allison's turbofan 41-A-1 engine	
	11 December 1968	First A-7D aircraft (#5) accepted by the AF at LTV facilities in Dallas	
C	1 September 1969	First production A-7D accepted (#8)	134a

A-10 FAIRCHILD REPUBLIC THUNDERBOLT II

- Subsonic, close air support/ground attack aircraft
- Primary armament is internally mounted seven-barrel 30mm GAU-8A cannon with 1,350 rounds
- Duplicated systems and armoring of vulnerable components are used to provide survivability

Milestone	Date	Event	Source
	8 September 1966	Gen. John J. McConnell, USAF chief of Staff, initiates design of a specialized close-air-support aircraft; issues Chief of Staff Decision Letter	
	December 1966	SOR/RAD (Requirements Action Directive) (A-X design for Advanced Attack Aircraft)	170; 135a
	6 March 1967	RFPs issued to 21 companies for design studies of a new, low-cost attack aircraft, the A-X	
	2 May 1967	Close-Air-Support (CAS) study contracts to General Dynamics/Convair, Grumman, McDonnell Douglas, and Northrop	
	June 1968	AF develops initial concept formulation package for the A-X	
	ecember 1968	Initial decision coordinating paper (DCP) is approved	
	August 1969	Supplemental CFP studies completed	135a
	December 1969	Milestone I DSARC Review, approval to proceed through validation phase and proposal evaluation	169a
A	April 1970	DepSecDef approves the A-X for competitive prototype development, establishes the A-X SPO at ASD	146a, p. 2-44
	7 May 1970	RFP issued to 12 airframe manufacturers	146a, p. 2-44; 147a, p. B-54
	10 August 1970	Six aircraft companies submit proposals	
	December 1970	DSARC I, approval of prototype phase subject to retention of DCP thresholds	146a, p. 2-44; 147a, p. B-54; 135a
	18 December 1970 (Prototype start)	Development contracts awarded to Northrop and Fairchild (competitive prototype development phase)	169a; 136a 146a, p. 2-44
	1 March 1971	AF designates A-X prototypes: Northrop, A-9; Fairchild, A-10	
	May 1972	First prototype flights: A-9, May 30; A-10, May 10	146a, p. 2-44; 147a, p. B-54; 169a

Milestone	Date	Event	Source
B	18 January 1973[22]	AF announces Fairchild's A-10 winner, DSARC II approves FSD	27, p. 293; 146a, p. 2-44; 147a, p. B-54; 135a, 169a; 136a
	1 March 1973	AF awards contracts to Fairchild and General Electric for ten preproduction aircraft	157; 146a, p. 2-45
	May 1974	Complete 30MM Gun/A-10 Prototype demo	157
	31 July 1974	DoD releases $39 million to proceed with initial production of 52 A-10s, DSARC IIIA limited production authorization	146a, p. 2-45; 169a; 157
	December 1974	Procurement funding authorized (22 A/C)	157
	January 1975	First DT&E aircraft delivered	146a, p. 2-45; 135a
	February 1975	IOT&E using preproduction aircraft begins	146a, p. 2-45;
	15 February 1975	First preproduction flight, DT&E at Edwards AFB	3a; 136a; 157
	July 1975	DSARC IIIB (Full Production Approval), release funds for 23 aircraft	157
	21 October 1975[23]	First production A-10 completes first flight	147a, p. B-54; 3a; 170
C	November 1975	First production aircraft delivered	135; 135a; 136a; 146a, p. 2-45; 157
	February 1976	Full-rate production authorized	146a, p. 2-45
	5 March 1976	IOT&E testing ends	
	20 March 1976	Turnover of the A-10 from the developing command, AFSC, to the using command, TAC--ceremony	
	March 1977	First combat-ready A-10 wing	
	June 1977	First operational squadron of A-10s activated	37, p. 119
	October 1977	First squadron achieves IOC	37; 136a, p. 31; 134a; 157
	May 1979	200th delivery (estimated)	

[22]Reference 134a dates development start in May 1971.

[23]Reference 135 reports first production flight as April 1976; Ref. 135a reports first production flight as March 1976.

AV-8B MCDONNELL DOUGLAS HARRIER II

- o Single engine, vectored thrust, V/STOL attack aircraft designed for close-air-support and attack missions
- o Developed directly from British Aerospace Harrier

Milestone	Date	Event	Source
A	March 1976	DSARC I approves flight demonstration phase but keeps options open	135a; 169a
	November 1978	First prototype flight	135a
B	April 1979	FSD contract awarded	135a
	July 1979	DSARC II review	135a, 169a
	November 1981	First FSD flight	135a; 147a, p. B-62
	September 1983	DSARC IIIA approves low-rate production	135a
C	September 1983	First production delivery	135a
	December 1983	DSARC IIIB approves full-scale production	135a

B-47 BOEING STRATOJET

o First jet bomber to serve in quantity with Strategic Air Command

Milestone	Date	Event	Source
A	Autumn 1943 (October)	AF invites Boeing and several other manufacturers to study jet bomber designs; AF outlines its tentative requirements	17, p. 114; 67
	March 1944	Boeing submits design for Model 424: straight-wing fuselage and tail unit like B-29	17, p. 114; 67
	April 1944	AF preliminary characteristics for medium bomber	67
	August 1944	ADO issued	
	November 1944	GOR/SOR issued for plane with minimum speed of 500 mph, operating altitude of 35,000 to 40,000 feet and range of 2,500 to 3,500 statute miles	142a, p. 102
	December 1944	Boeing Model 432 Phase I contract awarded	29, p. 147; 17, p. 114
	June 1945	Construction of mock-up authorized	17
	September 1945	Model 448 with swept-back wing proposed following trip by Boeing engineer to German front	29, p. 147; 17, p. 114; 142a, p. 102
	October 1945 (Prototype start)	Model 450 with external jet nacelles at various locations proposed--go-ahead from AF	17, p. 114; 29, p. 147; 67
	April 1946	Mock-up approved; Boeing receives L/C for Model 450; construction of two airplanes, spare parts, and tools authorized for Phase II	29, p. 147; 17, p. 115
	June 1946	Prototype construction begins	17, p. 115; 29, p. 147
	12 September 1947	First XB-47 rolls out 17 months after AF approval	67; 2
	17 December 1947	First flight of XB-47 prototype	21, p. 204; 17, p. 147; 19; 67; 5, p. 148; 142a, p. 101
	21 July 1948	Second prototype flies with more powerful J47 engine	21; 17, p. 115

Milestone	Date	Event	Source
B	3 September 1948	Letter of intent to Boeing for $30 million to build the A model	67
	November 1948[24]	L/C awarded for 10 planes and for later procurement of 41 B-47B's with a delivery period from January 1950 to April 1950	67; 142a, p. 103
	November 1948	First prototype accepted by AF	17, p. 115; 67
	December 1948	Second prototype accepted; flight testing begins	17; 67
	June 1949	By this time production order has been been doubled and delivery completion extended to December 1951	142a, p. 104
	7 October 1949	First XB-47, reequipped with J47 engine, makes first flight	17
	1 March 1950[25]	First B-47A completed	67
	25 June 1950	First production B-47A flies	19; 17, p.116; 147a, p. B-68
C	December 1950	Delivery of A models begins	17; 67
	December 1950	AF seeks production sources in addition to Boeing in response to Korean War requirements (Douglas and Lockheed are later chosen)	142a, p. 104
	March 1951	First B-47B completed	67
	April 1951	Production order rises to 1500	142a, p. 104
	26 April 1951	First B-47B flies	17, p. 116
	Mid-1951	Deliveries of the B-47B begin	17, p. 116
	August 1951	First B-47 assigned to SAC	75, p. 25
	June 1952	200th delivery	

[24]Reference 17 states that September is the contract date. Reference 29, p. 148, gives October 28 as the date on which 10 B-47A's were ordered at a cost of $37 million. Reference 5, p. 148, confirms the number 10.

[25]Reference 29, p. 148, gives 1 March as the date of first flight of the B-47A with the J47-GE-11 engine.

B-52 BOEING STRATOFORTRESS

- Still constitutes the major piloted element of SAC
- Capable of delivering a wide range of weapons, including conventional and nuclear bombs
- In third decade of service with USAF

Milestone	Date	Event	Source
	August 1944	AAF issues "Military Characteristics for Heavy Bombardment Aircraft"	146a, p. 4-1
A	April 1945	Design study begins; AF indicates interest to Boeing for turbine-powered long-range bomber	17, p. 120
	23 November 1945	GOR/SOR issued	146a, p. 4-2; 142a, p. 92
	January 1946	AF releases a new set of requirements for a heavy bomber; invites industry to submit	29, p. 152; 99; 91
	13 February 1946	Requirements directive circulated	142a, p. 92
	18 April 1946	Boeing makes Phase I proposal of $1,785,176	142a, p. 93
	5 June 1946	Source Selection; Boeing wins contract for further development with model 462	17, p. 120; 91; 146a, p. 4-2; 142a, p. 93
	28 June 1946	Letter contract approved	142a, p. 93
	September 1946	Assistant Chief of Air Staff states that B-52 is "an unrealistic type" because of its monstrous size	142a, p. 93
	17-18 October 1946	Boeing proposes smaller version, model 464	142a, p. 93
	26 November 1946	Chief of Engineering Division recommends approval of model 464	142, p. 93
	27 November 1946	B-52 requirements changed, shifted to specific atomic bomb delivery mission	142, p. 93
	7 January 1947	Conference decides Boeing should pursue model 464-17	142, p. 95
	23 June 1947	New military characteristics issued, including 10,000 mile range requirement (Boeing shifts to model 464-29 in response)	142, p. 95
	September 1947	Special Bombardment Subcommittee of the Aircraft and Weapons Board adopts new characteristics reducing range to 8,000	142, p. 95

Milestone	Date	Event	Source
		miles, increasing cruise speed to 500 mph and specifying air-to-air refueling	
	7 December 1947	New military characteristics issued	142, p. 95
	May-July 1948	Boeing studies use of J-40 turbojets	142, p. 95
	July 1948 (Prototype start)	Boeing receives contract for two prototypes	17, p. 120; 29, p. 152
	22 October 1948	Boeing goes to Wright Field to discuss turboprop model 464-35 only to be informed that AF is seriously interested in turbojet; Boeing subsequently draws up design and builds scale models of B-52 with swept wings and eight J-57 engines	142a, p. 96
	27 October 1948	Design accepted	29, p. 152
	January 1949	Board of General Officers permits Boeing to go ahead with model 464-49 without new competition	142a, p. 96
	April 1949	Mock-up approved	29, p. 152
	early 1950	Decided that both prototypes should use the more advanced J-57-3 engine (problems with the engine soon developed that delayed first prototype flight over a year)	142a, p. 97
B	February 1951	Letter contract for 13 B-52's as part of program acceleration	17, p. 121; 168a; 142a, p. 98
	May 1951	Mock-up inspection	142a, p. 98
	29 November 1951	XB-52 moved out of factory for ground test	17, p. 120; 91
	15 March 1952	YB-52 rolled out	17, p. 121; 91
	15 April 1952	First flight YB-52	22, p. 205; 29, p. 152; 91; 135; 17, p. 121; 146a, p. 4-2; 29b, p. 112; 142a, p. 97
	2 October 1952	XB-52 makes first flight	29, p. 152; 23, p. 215; 17, p. 120; 146a, p. 4-2; 142a, p. 98
	October 1952	Final production specifications approved	142a, p. 98
	18 March 1954	First production B-52 rolled out	53, p. 278; 146a, p. 4-2

Milestone	Date	Event	Source
	May 1954	First production airplane roll-out	142a, p. 98
	June 1954	First production B-52A delivered (B-52A designed for test purposes only)	168a; 146a, p. 4-2
	August 1954[26]	First production acceptance of RB-52B	168a
	5 August 1954[27]	First production B-52A flight	29, p. 152; 23, p. 215; 17, p. 121; 29b, p. 112
	1955	B-52 enters service	17, p. 120; 37, p. 116
	January 1955	First flight of B-52B production aircraft	168a
	29 June 1955	First deliveries of RB-52B to SAC	17; 142a, p. 98
C	November 1955	First delivery of B-52B production aircraft	168a
	January 1956	$248 million contract to Boeing	125
	August 1957	200th delivery	
	27 November 1957[28]	First delivery of B-52A to SAC	17, p. 121

[26]Reference 147a, p. B-76, lists August 1954 as the first B-52B delivery.

[27]Reference 147a, p. B-76, places first flight of B-52A in June 1954, during month of first delivery.

[28]Reference 29a, p. 112, identifies June 1955 as the date of first delivery of B-52B to SAC at Castle AFB.

B-58 CONVAIR HUSTLER

- o First supersonic strategic bomber put into production for the USAF
- o Three seater, no internal weapons bay
- o Ordered as one of the first systems under the "weapon system concept"

Milestone	Date	Event	Source
	October 1946	ADO issued	
A	March 1949[29]	Generalized bomber studies (GEBO II) indicate B-58 feasible	92, p. 52
	1949-1950	Convair conducted an exhaustive study for USAF to determine technical feasibility and general configuration of a supersonic bomber	69, p. 112
	1949	Convair designs win AF competition	17, p. 174; 25, p. 288
	17 February 1951	Letter contract for partial Phase I development awarded to Convair	156; 146a, p. 4-5
	26 February 1951	Letter contract for partial Phase I development awarded to Boeing	156; 146a, p. 4-5
	October 1951	Definitive contract negotiated with Convair for Phase I: wind tunnel tests and design studies, prior to construction of a mock-up	156
	8 December 1951	GOR published	92; 156
	28 February 1952	Plans made to terminate Project MX-1626 (Convair) because of lack of funds, but $100,000 increment granted to extend program through March 1952	156
	10 March 1952	Major realignment of MX-1626	156
	12 March 1952	General Phase I program initiated with Boeing and Convair: work limited to generalized design studies to narrow the range of alternatives	156
	15 May 1952	Definitive contract supersedes letter contract to cover general Phase I development	156
	9 October 1952	WADC recommends to HQ ARDC that MX-1964 be selected	156
	18 November 1952[30]	Convair MX-1964 selected over Boeing	156; 145, p. 4-6
B	12 February 1953	Convair given complete go-ahead for detailed Phase I development program	156; 145, p. 4-6

Milestone	Date	Event	Source
	17 February 1953	Letter contract authorizing preproduction planning to permit procurement of 18 weapon systems; detailed engineering; manufacturing of tools and fabrication of parts	
	August 1953	Mock-up inspected	29, p. 154
	13 October 1954[31]	Contract for 13 aircraft	19; 29, p. 154
	11 November 1956[32]	First flight of experimental airplane (J79-GE-1 turbojet engine)	17, p. 174; 19; 29, p. 154; 5, p. 156; 25, p. 288; 146a, p. 4-7
	4 December 1956	First supersonic flight of B-58	156; 147a, p. B-83
	February 1957	Second prototype's first flight	25; 17, p. 14
	Spring 1957[33]	Additional order of 17 aircraft added to original 13	25
	September 1959[34]	First production B-58A flies	17, p. 174; 15, p. 42
C	November 1959[35]	First production acceptance	146a, p. 4-7
	15 March 1960[36]	SAC receives first B-58A with J79-GE-5A engine	17, p. 175; 29 146a, p. 4-7
		Did not reach 200th delivery	

[29]Reference 146a, p. 4-5, gives this as the date that the GEBO II was authorized.

[30]References 17 and 12 give August 1952 as Convair MX-1964 selection and contract date. Reference 25 agrees on August.

[31]Reference 29, p. 154, gives this date as the ordering of first 13 aircraft. References 19 and 25 agree first order is for 13 but do not give date.

[32]Reference 147a, p. B-83, places first flight of YB-58A in November 1955.

[33]In Refs. 19 and 40, October is noted for the ordering of 17 planes.

[34]This was the 31st airplane produced.

[35]Reference 29, p. 155, gives September 1959 as date of delivery. Two other sources (25 and 54) give December 1959 as first production delivery, and Ref. 15 specifically gives 1 December 1959.

[36]Reference 25 states that in 1960 the B-58 reached operational status. Reference 69 agrees.

B-66 DOUGLAS DESTROYER

- o Originally intended as minimum modification of A3D Skywarrior but was substantially redesigned
- o EB-66B, C and E were the Air Force's only dedicated electronic warfare platforms until the EF-111A Raven entered service in 1982

Milestone	Date	Event	Source
B	February 1952	First contract start (production contract)	170a
	February 1954	First flight RB-66A	147a, p. B-90
	June 1954	Delivery of five test aircraft, RB-66's	170a
	December 1954	First delivery RB-66B	147a, p. B-90
C	January 1955	First delivery B-66B	170a
	January 1955	First flight B-66B	29b
	October 1955	First delivery RB-66C	147a, p. B-90
	March 1956	First delivery B-66B	29b

B-70 NORTH AMERICAN VALKYRIE

- o High-altitude, Mach 3 strategic penetrating bomber
- o Cancelled when vulnerability of high-altitude penetrating bombers became apparent

Milestone	Date	Event	Source
	14 October 1954	Original USAF requirement issued, GOR 38, for a Mach 3 intercontinental bomber to replace the B-52	25
	1955	Designated Weapon System 110A	25
	18 February 1955	System Requirement 22 issued	147
	22 March 1955	GOR 38 superseded by GOR 82	
	13 July 1955	Joint ARDC-AMC Source Selection Board proposes a list of six contractors	
A	8 November 1955	Boeing and North American (the only contractors to submit proposals) given Phase I development contracts	
B	23 December 1957	North American selected as prime contractor for Phase I	25
	24 January 1958	Letter contracts signed with North American and GE	147
	7 March 1958	Revised GOR 82 published; greater emphasis placed on speed	147
	19 March 1958	Acceleration of program announced	147
	7 October 1958	B-70 program set back to slower pace	147
	11 August 1959	Decision to use high-energy fuel abandoned; J-93-GE-5 engine canceled and J-93-GE-3 turbojets substituted	147
	December 1959	Program cut back to one prototype	25; 147
	Mid-1960	Partial restoration of budget cut	25
	31 October 1960	Announcement that $265 million would be available for the B-70 program	25
	March 1961	President Kennedy states that B-70 development as a full weapon system is unnecessary; suggests program be continued to explore flying at Mach 3; wants only a few experimental prototypes	25a
	March 1963	Decision to build only two XB-70A's for aerodynamic research	25a
	11 May 1964	First public showing	25a

Milestone	Date	Event	Source
	21 September 1964	First flight, first prototype	25a
	12 October 1964	Mach 1 exceeded (3rd flight)	25a
	17 July 1965	First flight, second XB-70A	25a
	14 October 1965	Mach 3 first attained (17th flight)	25a
	8 June 1966	Second XB-70A lost when it collided with F-104	25a
	25 March 1967	NASA takes over program management	25a

B-1A NORTH AMERICAN ROCKWELL

- o Original follow-on to the B-70 and Advanced Manned Strategic Aircraft (AMSA) programs, designed to fly Mach 2 at cruise altitude
- o Cancelled in favor of cruise missiles by President Carter

Milestone	Date	Event	Source
	1962	Informal design studies begin	27, p. 388
	September 1963	DepSecDef approves $15 million in FY 1965 to initiate development of a penetrating strategic aircraft	151
	October 1963	Approval changes; funds reduced to $5 million to provide for aircraft studies only	151
A	April 1964	Advanced Manned Strategic Aircraft SPO established	
	July 1964	Funded studies start	
	April 1965	Requirement issued for an Advanced Manned Strategic system	27
	20 November 1968	B-1 Development Concept Paper approved by the DepSecDef. The DCP approves a competitive design approach aimed at reducing the lead time from development to operational use without a commitment to FSD	151; 135a
	Early 1969	The SecDef changes the procurement plan from a competitive design approach to a full-scale engineering development program to be initiated in FY 1970	151
	3 November 1969	DoD issues RFP to industry (three airframe and two engine finalists)	27; 146a, p. 4-14
	14 January 1970	Airframe proposal due date	47a
	10 February 1970	Economic proposals due	47a
	4 June 1970	DSARC authorization to proceed into full-scale development	146a, p. 4-13; 169a
B	5 June 1970	Research, development, test, and evaluation contracts awarded to Rockwell and GE (original cost-plus-incentive contract for five flying prototypes, two structural test airframes and 40 engines)	27; 146a, p. 4-13
	January 1971	Design of the B-1 frozen. Contract quantities reduced to three flight test aircraft, one ground test aircraft, and 27 engines	27

Milestone	Date	Event	Source
	26 October 1974	First B-1 bomber prototype	49; 146a, p. 4-13
	23 December 1974	First flight successfully completed	50, p. 12; 146a, p. 4-13
	10 April 1975	First supersonic flight	51, p. 17; 146a, p. 4-13
	FY1976 Budget	Procurement of a fourth test aircraft as a preproduction prototype approved	27
	1 April 1976	No. 2 prototype flies	52
	14 June 1976	Third prototype flies	52, p. 32
	October 1976	Production decision scheduled	50, p. 12
	December 1976	DSARC III (production go-ahead), initial production contracts	146a, p. 4-13
	30 June 1977	President Carter announces that production of the B-1 will be cancelled	27a
	July 1977	B-1 program terminated	146a, p. 4-13
	July 1979	First production delivery scheduled	146a, p. 4-13

B-1B NORTH AMERICAN ROCKWELL

- o Redesigned B-1 brought into production by Reagan Administration
- o Has radar cross section 1 percent of B-52H whereas the B-1A had RCS that was 5-10 percent of B-52

Milestone	Date	Event	Source
	October 1981	Department of Defense approves B-1B for production	147a, p. 4-13; 157a
B	January 1982	Production and full-scale development contracts let to Rockwell for 100 B-1B's	157a; 146a, p. 4-13
	October 1984	First flight of B-1B	157a
C	June 1985	First operational B-1B delivered, #2 A/C	135a; 157a; 52d

C-5A LOCKHEED GALAXY

- o Large, long-range, heavy logistic aircraft
- o Developed under Total Package Procurement Concept (TPPC)
- o Able to operate from short landing fields and unpaved runways
- o Cargo volume is four times greater than C-141

Milestone	Date	Event	Source
	1963	CX-4 requirement issued by the USAF's Military Air Transport Service for a large logistics transport aircraft	17, p. 356
	November 1963	ADO for CX-X	146a, p. 3-9
	1964	C-5A studies confirm that concept of heavy logistics transport is feasible	141
A	25 March 1964	AF releases SOR 214 for a heavy logistics aircraft system	146a, p. 3-9
	May 1964	Initial design competition. Boeing, Douglas, and Lockheed invited to develop their initial designs further. Pratt and Whitney and General Electric invited to develop accompanying powerplant	27, p. 338; 146a, p. 3-9
	December 1964	SecDef gives final authorization for development and procurement	146a, p. 3-9
	11 December 1964	RFP released to contractors	151
	31 December 1964	AF awards program definition contracts	146a, p. 3-9
	April 1965	Proposals received--AF Source Selection Board begins evaluation	151
	August 1965	Source Selection Board recommends Boeing	151
	September 1965	Contractor selected, McNamara announces Lockheed winner of airframe development and production	135a; 146a, p. 3-10; 147a, p. B-98
B	1 October 1965[1]	General Electric and Lockheed proposals selected. Contract for five RDT&E aircraft plus an initial run of 53 aircraft	141; 158; 151; 27, p. 338; 134a; 146a, p. 3-13
	December 1965	$1,400 million to cover development and production of first 58 C-5A's	100; 146a, p. 3-10
	August 1966	Initial construction begins	27
	2 November 1967	GAO begins investigation of C-5A program	153
	February 1968	Roll-out of first aircraft	158

Milestone	Date	Event	Source
	30 June 1968	First of five development aircraft flies	27; 158; 17; 98; 135a; 134a; 146a, p. 3-10; 147a, p. B-98
	June 1969	First production article delivery	146a, p. 3-10
	30 June 1969	C-5A Category II testing begins	
	October 1969	Delivery of first operational aircraft	158
C	17 December 1969	First production model C-5A delivered to MAC (#6)	17, p. 356; 135a; 37, p. 122; 3a; 8, p. 173; 134a; 147a, p. B-98;
	June 1970	Enters operational service	48, p. 40
	September 1970	IOC	158; 134a
	May 1973	Final delivery. Deliveries do not reach 200	8, p. 173

[1]Source selection date: 30 September 1965--167.

C-5B LOCKHEED GALAXY

- Proposed by Lockheed to compete with the C-17 as a low-cost minimum-change of the C-5A Galaxy
- Has new wing and improved engine and improvements designed to decrease maintenance time and cost

Milestone	Date	Event	Source
	January 1980	Air Force announces CX strategic air-lifter requirement	135a
	September 1981	Lockheed submits C-5N (N:new) proposal	135a
	January 1982	Air Force selects C5-N over CX	135a
B	October 1982	Awarding of initial contract	158a
	December 1982	Awarding of initial production contract	158a
	July 1985	Rollout of first aircraft	135a; 52h, p. 19
	September 1985	First flight	135a; 52k, p. 23
	December 1985	First production delivery	52n, p. 28
C	July 1986	First operational delivery	52x

C-17A MCDONNELL DOUGLAS

- o Long-range transport aircraft with all-weather and short runway capabilities
- o Delayed because of C-5B procurement; IOC scheduled for FY92

Milestone	Date	Event	Source
	February 1980	Draft RFP	135a
	October 1980	Formal RFP	135a
A	August 1981	Source selection for McDonnell Douglas, no contract award	135a
	January 1982	CX cancelled	135a
	July 1982	Contract award to McDonnell Douglas	158b
B	January 1985	SecDef approves FSED	158c
	February 1985	SecDef Decision Memorandum (SDDM) approves FSD	135a; 52b, p. 42
	November 1985	DSARC I/II	169a
	December 1985	FSD contract award	135a; 52n, p. 20
	October 1986	DSARC III scheduled	169a
	FY 1990	First flight	135a; 52y, p. 30

C-130 LOCKHEED HERCULES

- o First transport produced under weapon system concept
- o Has been in service 25 years

Milestone	Date	Event	Source
	1951	Development starts after USAF decision to equip with turboprop transports	17, p. 350
	18 January 1951	ADO issued	
A	January 1951	USAF issues requirement for medium transport and work begins	24, p. 316; 89, p. 93; 146a, p. 3-1
	12 March 1951	GOR/SOR issued	
	2 July 1951[2] (Prototype start)	Source selection: Lockheed	89
	11 July 1951[3]	Contract for two prototype YC-130's	17, p. 350
	August 1951	Work begins at Lockheed-Burbank on two prototypes	89, p. 93
	January 1952	Direction from SPO to procure two YC-130's	146a, p. 3-2
	August 1952	Procurement directive issued for seven C-130A's	146a, p. 3-2
B	September 1952[4]	Production contract	17, p. 350; 146
	23 August 1954	First prototype YC-130 flight	89; 5, p.181; 17, p. 350; 134a; 135; 81, p. 15; 146a, p. 3-2; 135a
	March 1955	First production model rolled out	81
	7 April 1955	First production C-130A flies	5, p. 181; 89
	July 1955	AF flight test program initiated	146a, p. 3-2
C	December 1955[5]	First acceptance from production lot (#8)	135a; 134a; 146a, p. 3-2
	9 December 1956	Deliveries begin to TAC's 463rd Troop Carrier Wing	17, p. 350; 24; 89; 146; 37, p. 122
	September 1970	IOC	134a
	1 June 1957	First wing combat ready	90, p. 32
	February 1959	200th delivery	

[2]References 134a and 146a, p. 3-1, date the selection of Lockheed in June 1951.

[3]Reference 146a, p. 3-1, lists July 1951 as date of letter contract to Lockheed to proceed with design.

[4]Reference 24 gives 19 September 1952 as date of "prototype contract."

[5]Reference 146 gives September 1955 as date of a conditional acceptance.

C-133 DOUGLAS CARGOMASTER

- o Designed for transport of bulky loads not easily loaded into the C-124, but followed logical layout of the C-130
- o Depended on during Vietnam conflict for long-range missions that could not be performed by the C-130

Milestone	Date	Event	Source
	1952	Operational requirement for a heavy strategic freighter	17, p. 272
B	November 1952	Program start	170a
	February 1953	Douglas design accepted. Detail design work begins	17, p. 272; 24, p. 282; 147a, p. B-106
	1954	Production contract for 35 aircraft. No prototypes built (six preproduction aircraft, however)	11; 17, p. 272; 5, p. 161; 8
	31 January 1956	C-133 rolled out from Douglas, Long Beach	68, p. 186
	February 1956	First C-133A completed	24, p. 161
	23 April 1956[6]	First flight C-133A	5, p. 161; 24; 17, p. 272; 8, p. 177
	End of January 1957	Four planes delivered to AF for testing	24
C	29 August 1957[7]	First operational C-133 delivered	24; 17, p. 272; 5, p. 161
	31 October 1959	First flight C-133B	8, p. 177
	1961	Delivery completed (did not reach 200th delivery)	8, p. 177

[6]Reference 147a, p. B-106, dates first flight of C-133A in November 1955.

[7]Fuselage shape changed after first seven aircraft. Reference 147a, p. B-106, dates first delivery to USAF in April 1956.

C-141 LOCKHEED STARLIFTER

- o First jet aircraft designed from the outset as a military cargo airplane
- o Its purpose was to provide fast transportation over global ranges for the USAF Military Airlift Command and on strategic routes for Strike Command
- o Equipped with all-weather landing system

Milestone	Date	Event	Source
A	4 May 1960	SOR 182 issued for a large capacity intercontinental cargo jet	17; 146a, p. 3-5
	December 1960	Development Directive No. 145	146a, p. 3-5
	December 1960	RFP to four contractors	146a, p. 3-5
	13 March 1961	Design competition. Lockheed named winner over Boeing, SPO established	17; 59, p. 762; 146a, p. 3-5; 134a
B	April 1961	Letter contract for five RDT&E aircraft awarded to Lockheed	146, p. 3-1; 134a; 146a, p. 3-5; 147a, p. B-113
	May 1962[8]	Definitive contract for five aircraft	146, p. 3-2
	May 1962	Letter contract issued for advanced buy of 16 aircraft	146a, p. 3-5; 134a
	March 1963	Letter contract for 127 C-141's	146a, p. 3-5
	August 1963	RDT&E aircraft roll-out, Lockheed-Marietta	41; 134a; 146a, p. 3-5
	August 1963	First AF acceptance	146, p. 3-2
	17 December 1963[9]	First development C-141A flies from Dobbins AFB, GA	17, p. 354; 103, p. 8; 146a, p. 3-5; 135a
	May 1964	Definitive contract for 127 aircraft	146, p. 3-2
C	19 October 1964[10]	First production delivery	17, p. 354; 134a; 146, p. 3-1; 135; 146a, p. 3-5; 135a
	23 April 1965	Begins squadron operations with MAC	17, p. 354; 37, p. 124; 135a
	May 1965	IOC	134a
	April 1967	200th delivery	
	July 1968	Final delivery	8, p. 174

[8]Reference 17 gives 16 August 1961 as the date of the contract for five development C-141A's.

[9]Reference 147a, p. B-113, places first prototype flight in August 1963.

[10]This assumes that the first three aircraft of the production lot were used for development testing. Reference 147a dates first production delivery in May 1964.

KC-10A MCDONNELL DOUGLAS EXTENDER

- o Adapted from DC-10-30CF convertible passenger/freighter to serve as the USAF's Advanced Tanker/Cargo Aircraft (ATCA)
- o 17 KC-10's can fully support transatlantic deployment of an F-4 wing, whereas this same task requires 40 KC-135's

Milestone	Date	Event	Source
	1967	Advanced Tank Cargo Aircraft program initiated, SAC ROC 9-67	135a; 162e
	January 1972	Feasibility study contract	135a
A	January 1975	Study contracts with Boeing and MDC for design and evaluation of hardware for refueling	135a
	June 1976	MDC refueling boom contract	135a
B	December 1977	MDC selected over Boeing for long lead and pre-production planning with options to acquire 60 aircraft plus a contract for five years of logistic support, FSED contract, and FSD start	135a; 162e; 170a; 134a
	November 1978	KC-10 production award, DSARC III production go-ahead, DCP 148, for 2 A/C	135a; 162e
	June 1979	Completion of first aircraft	135a
	April 1980	Roll-out of #1 aircraft	162e; 134a
	April 1980	First flight	135a
	June 1980	Pre-delivery testing start	162e; 134a
	October 1980[11]	IOC	162e
C	March 1981	First production delivery, aircraft #2	162e; 170a; 134a
	September 1981	Delivery of aircraft #1	162e
	August 1982	SAC begins squadron operations	135a

[11]Reference 135a lists October 1980 as the month of first production delivery.

KC-135 BOEING STRATOTANKER

- o High-speed, high-altitude capability
- o Standard USAF tanker in the 1960s
- o Used as a tanker, cargo or personnel transport

Milestone	Date	Event	Source
	20 May 1952 (Prototype start)	Development of a Boeing jet transport prototype begins--"DASH 80"	17, p. 126; 85; 142
	August 1952	Boeing announces it is developing prototype (investing $15 million of its own funds)	142
	May 1953	Prototype mock-up	
	November 1953	Gen. Curtis LeMay issues a requirement for 200 jet tankers to support future B-52 and B-58 fleet	142
	March 1954[12]	Design initiated	134a
	May 1954	DASH 80 rolled out	142
		Hq ARDC invites Lockheed, Convair, Douglas, Boeing, Fairchild, and Martin to submit proposals for an advanced jet tanker	142
	15 July 1954	First DASH 80 prototype flight	17, p. 126
B	5 August 1954	AF announces purchase of limited number of Model 707 jet transports for $240 million	25, p. 270; 128
	5 October 1954[13]	Contract awarded to Boeing for 29 aircraft	17; 8; 134a
	2 March 1955	AF decides to order substantially more aircraft--brings total order to $700 million	128
	July 1955	Commercial development go-ahead	147a, p. B-268
	18 July 1956	KC-135A rolls out	25; 82, p. 11; 134a
	31 August 1956	First flight KC-135A	25; 17, p. 126; 37, p. 123; 134e; 147a, p. B-268
C	January 1957	First KC-135A accepted by AF	17, p. 126; 134a
	18 June 1957	Becomes operational; IOC; initial delivery to Castle AFB	25; 17; 134a
	January 1959	200th delivery	

Milestone	Date	Event	Source
	Mid-1966	Final delivery	8, p. 156
	January 1978	Contract to study DC-135 reengining alternatives	135a
	January 1980	AF selects CFM 56 engine	135a
	January 1981	Boeing receives development contract on KC-135R reengining	135a
	October 1982	First prototype flight, KC-135R	135a
	July 1984	First production delivery, KC-135R	135a

[12]Reference 134a calls this date the DSARC II equivalent.

[13]Reference 142 adds, "Because of SAC's urgent tanker requirements and logistics constraints, the competition idea was dropped and Boeing was chosen sole source contractor."

P-3 LOCKHEED ORION

- o Four-engine, turboprop, land-based ASW patrol plane
- o Based on the commercial turboprop, Electra
- o Replaced the P2V/P-2 Neptune and P5M/P-5 Marlin as the U.S. Navy's standard patrol aircraft

Milestone	Date	Event	Source
	1954	Electra designed to meet requirements set by American Airlines for a short-medium range transport	4
	June 1955	American and Eastern Airlines buy Lockheed's model L-188. Combined order: 75 aircraft	4
	Mid-1956	Navy considers alternative to P-2. Works with Lockheed on Model CL-353. Electra goes into serial production about this time	
	August 1957	USN calls for design proposals to provide a replacement for the P-2 Neptune. Manufacturers to modify aircraft already in production	18, p. 278
	December 1957	Lockheed submits Electra proposal to Navy	
	6 December 1957	First commercial Electra flies	4
B	24 April 1958	Lockheed wins Navy competition with adaptation of commercial Electra turboprop. R&D contract issued for P-3 system	18; 29, p. 318; 26
	19 May 1958	Fifth Electra flies (this is first aircraft delivered to the airlines)	4
	19 August 1958	First P-3 prototype flight (modified Electra)	26; 18; 14
	September 1958	Mock-up review	
	12 January 1959	Electra enters commercial service with Eastern	4
	25 November 1959	First flight of second prototype, YP3V-1, with full electronics	29, p. 318; 26; 11; 18; 135a
	October 1960	Seven production planes ordered	29, p. 318
	Late 1960	Name "Orion" adopted	18
	15 April 1961[14]	First flight production P-3A	11; 26; 135a

Milestone	Date	Event	Source
C	March 1962[15]	First acceptance of operational configuration	
	December 1966	200th delivery	

[14]There is much confusion on the flight date of the first production P-3A. Reference 150 claims March is the correct date. References 18 and 29 confirm 15 April but call it first flight of the preproduction P-3A.

[15]Assumes first lot of seven aircraft were for test (supported by Ref. 18, which says six aircraft were used for flight test and evaluation). Actual squadron delivery was not until mid-1962. Delay of squadron service was presumably due to avionics system. (References 18 and 26 give 13 August 1962 as squadron delivery date; Ref. 11 confirms August while Refs. 29 and 14 agree on July. Reference 135a gives August as date that Lockheed begins delivery.)

P-3C LOCKHEED ORION

- o Featured the A-NEW Advanced Integrated Avionics System for ASW missions
- o Updates I, II, III have enhanced navigation, computer storage, acoustic sensitivity and sensor pods
- o Procurement ends in FY87 budget in favor of new P-3G version

Milestone	Date	Event	Source
A	September 1965	P-3C project initiated	162h
B	September 1967[16]	First production contract on P-3C	162h
C	February 1969[17]	Accepted first production aircraft	162h
	March 1969	First flight production aircraft	162h
	July 1970	First P-3C squadron operational	135a
	25 August 1977	First Update II P-3C delivered	135a
	November 1981	Navy recommends production halt	135a
	January 1982	DoD restores funding	135a
	June 1984	First production Update III delivered	135a
	FY90	P-3G procurement to start	135a

[16] Reference 135a lists March 1968 as date of P-3C production contract.

[17] Reference 135a gives May 1969 as the date of P-3C production rollout.

S-3 LOCKHEED VIKING

- o Carrier-based anti-submarine search and strike aircraft (VSX)
- o Compact, high-wing monoplane powered by two GE TF34 turbofan engines in underwing pods

Milestone	Date	Event	Source
	February 1965	Tentative requirement by Chief of Naval Operations as follow-on to Grumman S-2E	
A	November 1965	Navy requests an expression of interest by aircraft manufacturers to perform concept formulation studies	
	December 1965	SOR issued. Ten companies respond	163
		Study contracts awarded to Lockheed-California and McDonnell Douglas	
	December 1967	Release of RFP to five manufacturers: General Dynamics/Convair, Grumman, McDonnell Douglas, North American Rockwell, and Lockheed-California	163; 17
	January 1968	RFP issued	135a; 147a, p. B-283
	April 1968	Five manufacturers submit proposals	11
	August 1968	Award of contract definition contracts	163
		Lockheed and General Dynamics asked to refine their proposals	11
	23 December 1968	Lockheed and General Dynamics submit new proposals	
B	1 August 1969	USN issues Engineering Development contract to Lockheed for six prototypes	163; 135a; 147a, p. B-283
	4 August 1969	Lockheed announces receipt of $461 million contract	27, p. 328
	March 1970	Full-size mock-up completed	163; 11
	8 November 1971[18]	First development aircraft rolls out	11; 27; 115, p. 38; 101, p. 18
	21 January 1972[19]	First flight development aircraft	11; 27; 135a; 8, p. 146; 147a, p. B-283
	March 1972	DSARC II approves limited production	169a
	April 1972	Production decision and contract	135a, 163

Milestone	Date	Event	Source
	4 May 1972	USN announces order for 13 S-3A's, first production lot	27, p. 329
	July 1972	First full systems aircraft flight	135a 147a, p. B-283
	February 1973	DSARC III, approve production of Lot IV and long lead time funds for Lot V	169a
	April 1973	First production aircraft flight	135a; 147a, p. B-283
	October 1973	DSARC II approves Lot V production	169a
	October 1973	Board of Inspection and Service trials set to begin	135a
C	October 1973[20]	First service delivery	8, p. 146
	November 1973	First S-3A carrier landing (USS Forrestal)	17, p. 282
	Late 1973[21]	Deliveries begin to U.S. Navy	11
	20 February 1974[22]	Officially introduced to fleet	27, p. 329; 8
	July 1975	First operational deployment	27

[18]Reference 27 claims 8 November is the date of the first R&D flight.

[19]Reference 48a states first flight is scheduled for early January (1972).

[20]This assumes that the first four development aircraft were used for testing.

[21]Reference 17, p. 282, says that "deliveries to the Air Anti-Submarine (Training) Squadron 41 (VS-41) begin in February 1974 for crew training."

[22]References 3a, 135a, and 147a list February 1974 as the date of first production aircraft delivery.

T-34C BEECH TURBO MENTOR

o Basic two-seat trainer with single turboprop engine

Date	Event	Source
March 1973	Modified T-34C initial contract	135a
April 1975	Contract for first 18 T-34C's	135a
June 1976	First production flight	135a
early 1977	First delivery	135a

T-38 NORTHROP TALON

- o Supersonic, lightweight twin-turbojet trainer designed to reproduce flight characteristics of supersonic operational fighter
- o Acquired by NASA as space flight readiness trainer

Date	Event	Source
January 1959	First prototype flight	147a, p. B-291
April 1959	First production model flight, YT-38 prototype	147a, p. B-291; 3a
May 1960	First production T-38A flight	3a
March 1961	Declared operational	147a, p. B-291

T-39A/B/D ROCKWELL SABRELINER

- o Designed to meet UTX requirement for combat readiness trainer and utility aircraft
- o Twin-engine, swept-wing turbojet with crew of two and six to ten passengers

Milestone	Date	Event	Source
A	March 1956	Design work begun	147a, p. B-299
	September 1958	First flight of prototype	147a, p. B-299
B	October 1958	Initial military order placed	147a, p. B-299
	June 1960	First flight production T-39A	147a, p. B-299
C	June 1961	Initial delivery of T-39A	147a, p. B-299

T-45A MCDONNELL DOUGLAS GOSHAWK

- o Two-place, single engine, carrier-capable, jet trainer
- o Modified from British Aerospace Hawk trainer for service on carriers

Milestone	Date	Event	Source
	June 1979	Mission Element Needs Statement (MENS)	135a; 169a
	August 1980	Study contracts for concept exploration	135a
A	November 1981	McDonnell Douglas selected as contractor	135a
	September 1982	Pre-FSD contract	135a
B	May 1986	Revised FSD contract signed	135a
	December 1987	First flight planned	135a

T-46 FAIRCHILD NEXT GENERATION TRAINER

- o Twin-engine, side-by-side two-seat light jet trainer to replace Cessna T-37
- o Cancelled because of budget restraints and contractor management difficulties

Milestone	Date	Event	Source
A	March 1978	GOR 01-78	164f
	June 1979	MENS approval	135a
	December 1979	Preliminary RFP	135a
	June 1980	Study contract awards	135a
B	July 1982	Aircraft/engine source selection and FSD contract	135a; 164f
	October 1982	Milestone II review	135a
	January 1984	Release of long lead items	135a
	February 1984	AFSARC limited production decision	164f
	March 1984	AFSARC approved continued FSD	135a
	February 1985	Roll-out of first FSD aircraft	52a, p. 25; 164f
	September 1985	AF considers cancellation	135a
	October 1985	First fly of prototype aircraft	52l, p. 22; 164f
	28 March 1986	AF confirms cancellation	135a
	October 1986	Congress votes to recompete Next Generation Trainer	135a
	13 March 1987	USAF/Fairchild reach termination agreement	135a
	January 1988	Scheduled delivery of first operational aircraft	52I, p. 22

BELL/BOEING VERTOL V-22 OSPREY (JVX)

- o Multi-service twin-engine tilt-rotor aircraft based on Bell XV-15
- o Capable of carrying up to 24 troops or 10,000 lb of cargo and will perform search and rescue, vertical replenishment, and ASW missions

Milestone	Date	Event	Source
	January 1981	MENS	135a
A	November 1982	DSARC I, demonstration and validation phase approved	169a
	January 1983	Navy RFP	135a
	April 1983	Preliminary design Phase I contract	135a
	June 1984	Phase II preliminary design contract	135a
B	17 April 1986	FSD approved, DSARC II meeting	135a; 169a
	May 1986	FSD contract awarded	135a
	1988	Production decision	135a
	February 1988	First flight	135a; 52p, p. 18
	1991	First USMC deliveries, IOC	135a; 52p, p. 18

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Appendix B

HELICOPTERS

AH-1 HUEYCOBRA (Bell Model 209)

- o Tandem-seat attack helicopter of about 14,000 lb gross take-off weight
- o More than 1,800 have been built for ten nations
- o Army engaged in major program to bring 1,000 Cobras to a standard AH-1S Cobra/TOW configuration

Milestone	Date	Event	Source
	March 1965	Design work begins	6, p. 269
		The original prototype was developed solely on the initiative of the Bell Helicopter Company through its Independent Research and Development Program	36, p. 21
	7 September 1965	First prototype flight	6, p. 269; 11, p. 210; 35, p. 188
	October 1965	Department of the Army authorizes the Army Materiel Command to conduct "comparative" test of the Piasecki 16H, the Boeing-Vertol CH-47A (modified), and the Bell Model 209 at Edwards AFB	37, p. 35
	December 1965	Prototype delivered to U.S Army for testing and evaluation	6, p. 269; 11, p. 210
	11 March 1966	U.S. Army announces HueyCobra will be produced, first AH-1G ordered	6, p. 269; 11, p. 210; 35, p. 188; 45
B	4 April 1966	Bell announces receipt of development contract for two "preproduction" helicopters, designated AH-1G	6, p. 269; 11, p. 210; 37, p. 35; 46, p. C-10
	13 April 1966	U.S. Army issues initial production contract for about 100 AH-1G helicopters	6, p. 269; 11, p. 210; 37, p. 35
C	June 1967	First delivery of AH-1G	6, p. 269; 45; 12; 36, p. 21; 46, p. C-10
	8 October 1967	Initial deployment of AH-1G in Vietnam	6, p. 269; 12; 13, p. 30
	March 1968	USMC requests funds for AH-1J (twin-turbine version, designated "SeaCobra")	4, p. 18; 45
	May 1968	Initial production order for 49 AH-1J SeaCobras	6, p. 270; 12

Milestone	Date	Event	Source
	1969	USMC acquires 38 AH-1G's for training and transitional deployment pending delivery of the AH-1J	6, p. 269
	14 October 1969	Preproduction AH-1J displayed	7, p. 240
	Mid-1970	First production AH-1J delivered	6, p. 270; 46, p. C-10
	March 1973	First delivery of preproduction AH-1Q to U.S. Army for firing tests. (The AH-1Q is an anti-armor version of the AH-1G that fires TOW missiles and has helmet site subsystem)	15, p. 9
	January 1974	U.S. Army awards contract to Bell to convert 101 AH-1Gs to the AH-1Q configuration	6, p. 270
		A total of 290 AH-1Q conversions was ordered, but after 92 had been completed, the AH-1Q program was terminated in favor of two improved models, the AH-1R (without TOW) and the AH-1S (with TOW)	36, p. 21
	10 June 1975	First delivery of production AH-1Q to U.S. Army	6, p. 270; 46, p. C-10
	1975-1976	U.S. Army awards contract for new production of advanced version of AH-1Q, designated AH-1S	7, p. 240; 46, p. C-10
	16 March 1977	First delivery of new production AH-1S	7, p. 240; 46, p. C-10
	October 1977	First deliveries of AH-1T	46, p. C-10
	November 1983	First fly AH-1T+	45
	March 1986	First AH-1W delivery	45

AH-64 (AAH) BLACK HAWK (Hughes Model 77)

- o Single-rotor, twin-engine all-weather and all-light attack helicopter for antitank/armor, close air support and airmobile escort missions
- o Armed with 8 to 15 laser guided Hellfire missiles and 30mm Hughes "chain gun"

Milestone	Date	Event	Source
	7 August 1972	U.S. Army Systems Acquisition Review Council recommends ending Boeing-Vertol Cheyenne program	4, p. 7
A	September 1972	DSARC I, requirement approved	45; 47
	10 November 1972	RFP for advanced attack helicopter released	4, p. 8; 12
	January 1973	Competitive engineering development contracts awarded to Bell and Hughes	46, p. C-2
	22 June 1973	U.S. Army awards Phase I development contracts to Bell and Hughes for airframe and full system (prototype program)	16, p. 11; 4, p. 12; 7, p. 320; 45
	19 April 1975	Bell begins airframe ground tests	17, p. 35; 4, p. 21
	June 1975	Hughes begins airframe ground tests	4, p. 21; 7, p. 320
	30 September 1975	First prototype flight of Hughes YAH-64	18, p. 23; 4, p. 21; 45; 36, p. 44; 48
	1 October 1975	First prototype flight of Bell YAH-63	18, p. 23; 4, p. 21
	February 1976	U.S. Army changes armament and targeting requirements	4, p. 30
	May 1976	Hughes delivers first prototype to U.S. Army for flight tests	36, p. 44; 7, p. 32
	June 1976	Bell delivers first prototype to U.S. Army for flight tests	4, p. 23
	September 1976	U.S. Army changes machine gun ammunition requirements	4, p. 30; 45; 46, p. C-2; 47
	30 September 1976	Government Competitive Testing ends	4, p. 23
	27 November 1976	Tactical Air Direction System/Pilot Night Vision System (TADS/PNVS) proposals submitted	12

Milestone	Date	Event	Source
B	10 December 1976	U.S. Army awards Phase II development contract to Hughes	4, p. 24; 42, p. 728
	10 March 1977	TADS/PNVS development contracts awarded	12
	July 1978	First flight of full-system prototype	45
	June 1979	First prototype flights with TADS/PNVS systems	41, p. 43
	January 1980	Competitive flyoff between Northrop and Martin Marietta TADS/PNVS systems begin	41, p. 43
	March 1982	DSARC III	45
	September 1983	Rollout of first production aircraft	45
	January 1984	First production aircraft flight	45
C	January 1985	Delivery of first production units to operational status, first production aircraft flight	45; 48

ARMY HELICOPTER IMPROVEMENT PROGRAM (AHIP)

- o Modified version of the Bell OH-58 to serve as a survivable helicopter to perform reconnaissance, surveillance, target acquisition and target designation missions in support of the attack helicopter fleet
- o Modified OH-58C to Bell's Model 406 (OH-58D) by adding mast-mounted sight, four-blade composite main rotor, larger tail rotor and the Allison 250-C30 engine

Milestone	Date	Event	Source
	December 1971	Aerial Scout RFP	45
	February 1974	Advanced Scout Helicopter (ASH) draft RFP	45
	October 1975	Industry responds to the RFP	45
	1977	Program put off	45
	May 1980	First RFP for AHIP	49
	September 1980	Army Systems Acquisition Review (ASARC) II	49
	October 1980	DSARC II, FSED approved	49
B	September 1981	Start of FSED (using OH-58 airframe)	45; 49
	April 1982	DSARC II, development approved	47
	September 1985	DSARC III meeting held	47
	October 1985	DCP approves production	49
C	December 1985[1]	First production delivery	50, p. 69; 49

[1]Reference 45 dates first production delivery in March 1986.

CH-3, HH-3 JOLLY GREEN GIANT (Sikorsky S-61R)

- o Twin-engine, single-rotor, medium-lift, amphibious transport helicopter
- o Used by Air Force for amphibious transport (CH) and search and rescue (HH)

Date	Event	Source
November 1962	USAF selects S-61R for transporting troops, cargo, personnel, or casualties (Model S-61 already in production as SH-3 for Navy)	2, p. 93
8 February 1963	USAF orders 22 CH-3Cs	10, p. 295; 36, p. 68
17 June 1963	First prototype flight of CH-3C	10, p. 295
July 1963	USAF announces CH-3C selected for long-range support system	2, p. 93; 10, p. 295
July 1963	First flight of production CH-3C	10, p. 295; 34, p. 258; 36, p. 68
30 December 1963	First operational delivery of CH-3C for drone recovery duties at Tyndall AFB, Florida	6, p. 454; 10, p. 295; 36, p. 68
30 December 1963	S-61R receives FAA Type Approval	10, p. 295
February 1966	USAF orders all CH-3Cs converted to uprated configuration, designated CH-3E	6, p. 454; 11, p. 348; 24, p. 122
	(Forty-two new CH-3Es built in addition to the CH-3C conversions)	36, p. 38
	USAF Aerospace Rescue and Recovery Service uses a version of the CH-3E designated HH-3E. It differs from the CH-3E in having armor, self-sealing fuel tanks, retractable flight refueling probe, defensive armament, and a rescue hoist	11, p. 348
	(Fifty CH-3Es converted to the HH-3E standard)	36, p. 68
1968	First delivery of the HH-3F Pelican The USCG uses the HH-3F for extended search and rescue missions. While similar to the HH-3E, it is unarmed and has no armament but is fitted with advanced electronic search equipment	36, p. 68

CH-46, UH-46 SEA KNIGHT (Boeing-Vertol Model 107)

In 1956, Vertol began preliminary design and engineering of a twin-turbine transport for commercial and military markets. Vertol wanted to take advantage of the high power, small size and light weight of the shaft turbine engines that were then becoming available. The prototype work was performed entirely under company funding.

Milestone	Date	Event	Source
	May 1957	Construction of prototype begins	8, p. 294; 10, p. 193
	22 April 1958	First prototype flight	8, p. 294; 12; 11, p. 222; 46, p. C-19; 45
B	July 1958	U.S. Army orders ten Model 107s for evaluation	3, p. 174
	27 August 1959	First flight of U.S. Army evaluation aircraft	3, p. 174; 34, p. 246; 36, p. 32
	25 October 1960	U.S. Army tests begin	8, p. 294; 10, p. 193
	February 1961	USMC announces Model 107 as the winner of a design competition for a medium assault helicopter, designated CH-46A. Boeing-Vertol receives initial order for 14 aircraft	3, p. 175; 12; 11, p.223; 36, p. 32; 45
	19 May 1961	First flight of production CH-46	10, p. 193
	26 January 1962	Model 107 receives FAA Type Approval	10, p. 193
C	31 May 1962[1]	First production delivery CH-46A	51
	16 October 1962	First flight of production CH-46A	8, p. 295; 11, p. 223; 45; 34, p. 246; 12; 46, p. C-19
	July 1964	First operational delivery of the UH-46A to Utility Helicopter Squadron One, Ream Field, California. (The UH-46A is the USN version of the CH-46A.)	8, p. 294; 12; 45
	1 November 1964	CH-46A officially accepted by USMC	19
	November 1964	USN Board of Inspection and Survey test completed (required for fleet release)	8, p. 295; 11, p. 223
	December 1964	First operational deployment	12
	March 1966	First deployment in Vietnam	12; 11, p. 223

Milestone	Date	Event	Source
	September 1966	First production CH-46D delivered from converted CH-46A production line. (The CH-46D is an uprated version of the CH-46A and all aircraft produced after September 1966 were of the 46D configuration.)	12
	September 1966	First UH-46D delivered from converted 46A production line	12

[1]References 45 and 46, p. C-19, date first CH-46A delivery in 1963.

CH-47 CHINOOK (Boeing-Vertol Models 114/234)

- o Turbine-powered, all-weather medium-lift helicopter designed for "battlefield mobility" missions
- o Carries 4000 lb internally or 16,000 lb externally plus 40 fully equipped soldiers
- o 550 Chinooks served in Vietnam
- o Currently upgrading 436 A/B/C models to the D configuration

Milestone	Date	Event	Source
	1956	U.S. Army announces intention of replacing piston-engined transport helicopters with turbine-powered versions, development begins	6, p. 290; 45
	March 1959	Boeing-Vertol Model 114 wins design competition	6, p. 290; 3, p. 173
	June 1959	U.S. Army/USAF Selection Board awards initial contract for five prototypes	6, p. 290; 11, p. 224; 36, p. 34; 46, p. C-26; 45
	1960	First production contract for CH-47A	11, p. 224
	28 April 1961	First prototype delivered for ground tests	2, p. 23; 10, p. 195; 11, p. 224
	21 September 1961	First prototype flight	2, p. 23; 10, p. 195; 11, p. 224; 34, p. 245; 46, p. C-26
	April 1963[1]	First A model delivered	52
	October 1966	First flight of CH-47B, developed from the CH-47A with larger engines, redesigned rotor blades, and other minor changes	3, p. 174; 11, p. 224; 34, p. 245; 36, p. 34
	10 May 1967	First delivery of CH-47B	3, p. 174; 11, p. 224; 36, p. 34
	14 October 1967	First preproduction delivery of the CH-47C for testing. The CH-47C is a further development in the Chinook series with larger engines, strengthened transmission, and increased fuel capacity	3, p. 174
	14 October 1967	First flight of CH-47C	36, p. 34
	Spring 1968	First delivery of production CH-47C	3, p. 174

Milestone	Date	Event	Source
	September 1968	First deployment of CH-47C in Vietnam	36, p. 34
B	October 1975	CH-47D DSARC II	53
	June 1976	Modernization R&D contract awarded	53
	May 1979	First flight of CH-47D	53
	October 1980	CH-47D DSARC III	53
	October 1980	Initial production contract for CH-47D	53
C	May 1982	Initial production delivery of CH-47D	53

[1]Reference 2, p. 23, dates first production delivery of CH-47A on 16 August 1962; Ref. 36, p. 34, dates first operational delivery of a CH-47A in December 1962.

CH-53 SEA STALLION (Sikorsky S-65A)

Antecedents to the S-65A: The S-56 was a new design (Sikorsky's first twin-engine helicopter) built to meet USMC requirements for an assault transport capable of carrying some 26 troops. It retained the classic Sikorsky layout of a single main rotor and anti-torque tail rotor. The new features included placing the two engines in pods on each side of the fuselage (leaving the cabin area for load carrying). The main legs of the undercarriage were retractable into the engine pods and clam-shell doors below the flight deck provided direct access to the cabin. Empty weight was about 20,800 lb and gross weight was about 31,000 lb. It used two Pratt and Whitney R-2800 engines and could carry 20 troops or 1900 cu ft of cargo.

Milestone	Date	Event	Source
	9 May 1951	USN issues prototype contract	2, p. 87; 3, p. 135
	18 December 1953	First prototype flight	2, p. 87; 3, p. 135
	25 October 1955	First production model flight	2, p. 87
	26 July 1956	First operational delivery to USN	2, p. 87; 3, p. 136

U.S. Army also buys some S-56s

The S-60 was Sikorsky's first attempt at building a flying crane helicopter. The design work was jointly funded by the company and the USN. To speed development and minimize flight testing, the S-60 used the power plant, rotor, and transmission systems from the S-56. As with the S-56, the Pratt and Whitney R-2800 engines were mounted in outrigger pods into which the wheels could be partially retracted. The fuselage was a boom with a cockpit at the front end, the main rotor mounting in the middle, and the tail rotor at the back end. The payload of up to six tons could be attached under the boom between the wheels like a module or could be slung from a hoist.

	May 1958	Design work begins	2, p. 97
	25 March 1959	First prototype flight	2, p. 97
	3 April 1961	S-60 prototype destroyed in crash	2, p. 97

Work on the S-64 had begun before the S-60 crash and was a company-funded development of a turbine-powered variant to the S-60. It had a similar fuselage and rotor system but used a six-bladed rather than a four-bladed main rotor. It also differed in that its two 4050 shp JFTD-12A shaft turbines were mounted side by side on top of the fuse- lage boom immediately below the rotor. It also had a new undercarriage design with "kneeling" capability. Its personnel and cargo pod could carry 68 troops or 48 stretchers or 55 airline passengers. Its empty weight was about 17,200 lb and its gross weight was about 38,000 lb. For related dates, see CH-54A.

The S-65 incorporated parts from the S-64, but its fuselage resembled a scaled-up version of the S-61R although it was flat-bottomed, which differed from the S-61R's boat hull. The watertight hull had sponsons amidships that housed the fuel tanks and main undercarriage. The rotors, transmission, and

other dynamic components were taken from the S-64. However, the S-65 had a rear-loading ramp and could carry about 8,000 lb internally or 13,000 lb externally. Standard power plant was the T64-GE-6 shaft turbine.

Milestone	Date	Event	Source
B	27 August 1962	USN announces that Sikorsky has been selected as the USMC heavy assault helicopter	6, p. 456; 10, p. 297; 11, p. 250
	August 1962	Initial production contract awarded for the CH-53A	1/Part 1
	14 October 1964	First prototype flight	6, p. 456; 10, p. 297; 20, p. 37; 46, p. C-34; 45
	June 1966	First delivery of CH-53A	12; 45; 46, p. C-34
C	September 1966	First operational aircraft delivery	45
	September 1966	USAF orders eight HH-53Bs. The HH-53B is similar to the CH-53A and is used by the USAF Aerospace Rescue and Recovery Service. It is armed and has jettisonable fuel tanks, retractable refueling probe, and a rescue hoist.	6, p. 457; 11, p. 350
	January 1967	First deployment of CH-53A in Vietnam	11, p. 350
	15 March 1967	First flight of production HH-53B	6, p. 457; 11, p. 350; 21, p. 67; 24, p. 122
	June 1967	First delivery of HH-53B	6, p. 457; 11, p. 250; 24, p. 122; 36, p. 71
	30 August 1968	First delivery to USAF of HH-53C, an improved version of the HH-53B	6, p. 457; 24, p. 122; 36, p. 71
	3 March 1969	First delivery to USMC of CH-53D, an improved version of the CH-53A	6, p. 457; 36, p. 71
	27 October 1970	USN announces plans to form mine countermeasures squadrons; the unit is formed using 15 CH-53As borrowed from the USMC and redesignated RH-53A	6, p. 458
	31 January 1972	Last delivery of CH-53D. (A total of 265 are delivered to the USMC.)	6, p. 457; 36, p. 71
	February 1972	Sikorsky announces receipt of USN award of an advanced procurement authorization for 30 RH-53Ds, an improved version of the RH-53A	6, p. 458

Milestone	Date	Event	Source
	27 October 1972	First prototype flight of the RH-53D	6, p. 458
	September 1973	First delivery of the RH-53D	6, p. 458; 36, p. 71
	1 March 1974	First YCH-53E prototype flight. Developed for the USMC and USN as a utility and tactical support helicopter, the CH-53E is a three-engine development of the S-65A and has a seven-bladed main rotor with titanium blades, an uprated transmission, modified tail surfaces, and other airframe and equipment improvements	36, p. 72
	Early 1976	Flight testing of preproduction models begin	36, p. 72
	May 1976	Structural demonstration tests begin	36, p. 72
	28 February 1978	First production order for six CH-53Es received from USMC	36, p. 72

CH-54 TARHE (Sikorsky S-64A)

Background: See CH-53.

Date	Event	Source
9 May 1962	First S-64A prototype flight	2, p. 97; 10, p. 296; 8, p. 451; 36, p. 70; 46, p. C-41
June 1963	U.S. Army orders six S-64As to test the heavy lift concept for increasing mobility under battlefield conditions (designated YCH-54A)	8, p. 451; 10, p. 296; 25, p. 324; 36, p. 70; 46, p. C-41
30 June 1964	U.S. Army accepts first YCH-54A	10, p. 296; 22, p. 57; 36, p. 70; 46, p. C-41
September 1964	First operational delivery	54; 7, p. 403
October 1964	First delivery of test vehicle	10, p. 296
3 July 1965	S-64A receives FAA Type Approval	6, p. 455
January 1968	First delivery of skycrane modular van accepted by government	23, p. 23
4 July 1968	Sikorsky announces receipt of U.S. Army contract to increase payload capacity of the CH-54A. Required design improvements to the engine, gearbox, rotor head and structure. The Army also wants improved altitude and hot weather operating capabilities (designated CH-54B)	6, p. 455
1969	First operational delivery of CH-54B	6, p. 455

HH-43, UH-43, OH-43 HUSKIE (Kaman K-600/600-3)

Kaman had developed several predecessors to the K-600 during the late 1940s and early 1950s. The USN bought one K-225 for evaluation in March 1950 (the K-225 had received FAA Type Approval September 16, 1949). In June 1950, the USN purchased another K-225. These tests led to a USN contract to develop the K-240 and on September 5, 1950, the USN ordered 29 K-240 helicopters (first delivery was November 1951). The K-240 was the immediate predecessor to the K-600.

Milestone	Date	Event	Source
B	June 26, 1950	USN announces K-600 winner of a design competition for a USMC liaison and general utility helicopter. The contract is for "off the drawing board" development, designated OH-43D	2, p. 53; 3, p. 162
	27 September 1956	First prototype flight using an XT53 engine in a modified OH-43D airframe (predecessor to the K-600-3)	2, p. 51; 3, p. 162; 9, p. 249; 34, p. 249
	27 December 1956	USN orders 24 UH-43C (the K-600) for general utility duties	2, p. 53; 3, p. 162
	1957	USAF conducts evaluation for local crash rescue. It found no acceptable design, but ordered the K-600 as an interim measure until the K-600-3 was ready	2, p. 51
C	April 1958	First delivery of OH-43D to USMC	3, p. 162
	May 1958	First delivery of production UH-43C to USN	2, p. 53
	1 August 1958	First operational delivery of UH-43C	2, p. 53
	19 September 1958	First flight of production USAF HH-43A (differs from USMC and USN K-600s only in its rescue equipment)	3, p. 162; 2, p. 51
	November 1958	First delivery of HH-43A to USAF	2, p. 51
	13 December 1958	First flight of K-600-3 prototype (which became the HH-43B)	3, p. 162; 2, p. 51; 34, p. 249
	August 1964	First flight of the production HH-43F. (This was an improved version of the HH-43B, with greater power, increased fuel capacity, and other minor changes. It was designed for operations where optimum altitude performance under hot-weather conditions was required.)	24, p. 122; 34, p. 249

HH-52A (Sikorsky S-62A)

Based on the S-55, the S-62A had identical main and tail rotors, transmission systems, and other dynamic components with its predecessor. The main difference was that it used turbine rather than piston engines. It had a different fuselage design for fully amphibious operations (flying boat hull and undercarriage wheels that were semiretractable within two outrigged stabilizing floats. The single GE shaft turbine engine was mounted above the main cabin, which could accommodate a two-person crew and 10-12 passengers.

Date	Event	Source
Late 1957	Sikorsky begins design work on S-62	3, p. 150
14 May 1958	First prototype flight	10, p. 296; 36, p. 69
30 June 1960	S-62A receives FAA Type Approval	3, p. 150; 10, p. 296
6 February 1962	After service testing the S-62A, the USN orders four production models for the USCG	3, p. 150; 2, p. 95
January 1963	First production delivery of HH-52A	10, p. 296

LHX (LIGHT HELICOPTER, EXPERIMENTAL)

- o Provides for development of low-cost, lightweight, highly agile family of scout/attack and utility/observation helicopters to complement the AH-64 and UH-60 aircraft
- o Intended to replace current inventory of UH-1, AH-1 and OH-58 aircraft
- o Will be funded until FSD under the Army's Advanced Rotorcraft Technology Integration (ARTI) program

Milestone	Date	Event	Source
	1979	Program first defined	45
	late 1983	Army Aviation report: 5, 15 and 20 year plans	55
A	June 1983	Concept definition begins	55
	August 1983	Justification for Major System New Start (JMSNS)	47
	1984[1]	Begin concept definition	55
	mid 1985	Begin engine development	45
	August 1986	Preliminary design contract	55
	April 1987	ASARC/DSARC II planned	55, 45
	January 1988	FSD start planned	55, 45
	January 1995	Initial production deliveries planned	45

[1]Reference 45 places the start of concept definition in 1983.

OH-6 CAYUSE (Hughes Model 369)

- o Original winner of LOH (Light Observation Helicopter) compeitition
- o Served extensively in Vietnam carrying special gear and weapons including the XM-27 gun or XM-75 grenade launcher
- o Army eventually bought 1,434

Milestone	Date	Event	Source
	1960	DoD issues Technical Specification No. 153 to initiate design competition for a light observation helicopter (light-weight, four-place helicopter with Allison T63 gas turbine engine capable of carrying a 400-lb payload plus pilot and full fuel load. Minimum speed was to be 110 kt)	3, p. 156; 2, p. 46
	October 1960	RFP issued	12
	19 May 1961	U.S. Army announces Bell and Hiller selected to build prototypes (Twelve companies had submitted 22 designs in the LOH competition)	6, p. 359
	June 1961	Hughes is added to the list of winners; all three companies to build five prototypes each	6, p. 359
	8 December 1962	First prototype flight, Bell Model 206	2, p. 14; 12
	26 January 1963	First prototype flight, Hiller Model 1100	2, p. 46; 11, p. 254
	27 February 1963	First prototype flight, Hughes Model 369	3, p. 156; 9, p. 245; 11, p. 275; 36, p. 42
	November 1963	U.S. Army selection trials begin	3, p. 157
B	26 May 1965	U.S. Army selects Hughes 369 as LOH. Initial order for 714 helicopters issued, designated OH-6 Cayuse	9, p. 245; 11, p. 275; 26, p. 20; 45
C	September 1966	First delivery of production OH-6	3, p. 157; 45

OH-23 RAVEN (Hiller UH-12)

- During the late 1940s, Hiller designed a light single-engine helicopter that subsequently evolved into the UH-12 prototype.

Date	Event	Source
14 October 1948	UH-12 receives FAA Type Approval	3, p. 121
1950	Modifications to the rotor blades and use of a larger engine became the UH-12A model	3, p. 121
May 1950	USN and the U.S. Army each procure one UH-12A for evaluation	2, p. 41
8 May 1950	UH-12A receives FAA Type Approval	2, p. 41
August 1950	Service evaluations completed	2, p. 41
1950	USN orders small number of UH-12As as trainers, designated HTE-1	2, p. 41
1950	U.S. Army orders about 100 UH-12As as the OH-23 Raven	2, p. 41
1951	Deliveries to USN and U.S. Army begin	2, p. 41
1951	After operational experience in Korea, the U.S. Army requests certain modifications to improve performance under wartime conditions. This led to the development of the UH-12B	2, p. 41
2 November 1951	UH-12B receives FAA Type Approval	2, p. 41
Date NA	U.S. Army orders UH-12B as OH-23B; eventually buys about 273 OH-23Bs, most of which were assigned to the Primary Helicopter School	2, p. 41
1955	Major design changes lead to the UH-12C	3, p. 122
12 December 1955	UH-12C receives FAA Type Approval	3, p 122
1956	U.S. Army begins receiving UH-12C designated OH-23C	3, p. 122
3 April 1956	First prototype flight of UH-12D, an improved version of the UH-12C	3, p. 122; 2, p. 42
December 1957	First delivery of UH-12D to U.S. Army, designated OH-23D	2, p. 42
23 December 1957	UH-12D receives FAA Type Approval	2, p. 42

Date	Event	Source
6 January 1959	UH-12E, an improved version of the UH-12D, receives FAA Type Approval	2, p. 42
1963	U.S. Army orders UH-12E as the OH-23G with the last order for OH-23Ds specifying that they be upgraded to the 23G configuration	10, p. 232

OH-58 KIOWA (Bell Model 206A)

- Bell developed the Model 206A JetRanger as a commercial venture after losing the original LOH competition to Hughes (see OH-6). The Model 206A was based heavily on Bell's LOH entry.

Date	Event	Source
July 1965	Company-funded construction of the Model 206A prototype begins (two months after Hughes wins the LOH competition)	11, p. 207
10 January 1966	Bell Model 206A first prototype flight	3, p. 158; 11, p. 207
20 October 1966	Model 206A receives FAA Type Approval	3, p. 158; 11, p. 207
August 1967	U.S. Army reopens LOH competition	12; 27, p 15; 46, p. C-65
February 1968	USN selects Bell 206A JetRanger for trainer, designated TH-57A SeaRanger	29, p. 17
8 March 1968	U.S. Army names Bell winner of reopened LOH competition and orders first increment of planned 2,200 helicopter buy, designated OH-58A	6, p. 268; 28, p. 326; 46, p. C-65
October 1968	First delivery of TH-57A to USN	12
23 May 1969	First delivery of OH-58A Kiowa	12; 6, p. 268; 36, p. 24
August 1969	First deployment of OH-58A in Vietnam	6, p. 268; 36, p. 24
30 June 1976	U.S. Army grants "development qualification contract" to Bell to convert OH-58As to an improved standard, designated OH-58C	7, p. 239

SH-3 SEA KING (Sikorsky S-61A/B/F)

- o Twin-engine, single-rotor, medium-lift, amphibious transport helicopter
- o 255 SH-3As produced by Navy for ASW

Milestone	Date	Event	Source
B	23 September 1957	USN awards contract for development of an amphibious antisubmarine helicopter	6, p. 452; 10, p. 294; 36, p. 65; 46, p. C-71; 45
	11 March 1959	First prototype flight of the SH-3A (first known as the HSS-2)	2, p. 91; 6, p. 452; 10, p. 294; 46, p. C-71; 45
	1960	First delivery of prototype for service testing (seven had been ordered)	3, p. 148
	8 February 1961	Navy Board of Inspection and Survey trials begin	10, p. 294
C	September 1961	First fleet delivery	6, p. 452; 36, p. 65; 46, p. C-71; 45
	April 1964	USN contract announced for conversion of SH-3As for mine countermeasures duty (carry, stream, tow, and retrieve a variety of mine countermeasures gear), designated RH-3A	6, p. 453; 10, p. 293
	1965	Deliveries begin of RH-3A conversions	6, p. 453; 135a
	June 1966	Deliveries begin of uprated SH-3As, designated SH-3D	6, p. 453; 11, p. 346
	10 June 1971	USN announces contract to convert all SH-3A, SH-3D, and SH-3G helicopters to an improved configuration, designated SH-3H (had new sonar equipment for anti-submarine warfare duties and new radar for antimissile defense)	6, p. 453

SH-34 SEABAT, CH-34 CHOCTAW, UH-34 SEAHORSE (Sikorsky S-58)

The S-55 was the forerunner of the S-58 and the S-62. Before this model, Sikorsky had built primarily small single-seat or two-seater helicopters, mainly for the USAAF and USN during World War II. The layout of the S-55 was similar to earlier Sikorsky efforts with the single main rotor and a tail boom carrying the tail rotor. The S-55 differed in its larger size and in the location of the engine in the nose of the vehicle with the transmission shaft running up through the center of the cockpit to the rotor head, leaving the main cabin area free for cargo.

Date	Event	Source
1948	Five S-55 prototypes ordered	2, p. 89
10 November 1949	First S-55 prototype flight	2, p. 89; 34, p. 254
28 April 1950	USN places first production order for S-55	2, p. 89
27 December 1950	First operational delivery to Utility Squadron HU-2	2, p. 89
	USN eventually buys almost 200 S-55's	
August 1950	USMC adopts S-55 as assault transport with self-sealing fuel tanks	2, p. 89
1951	USAF issues first contract for production S-55s	2, p. 89
	USAF eventually buys over 450 S-55s	
2 April 1951	First delivery of S-55 to USMC	2, p. 89

The S-58 was designed specifically for antisubmarine warfare duties with the USN. The S-55 had been used but lacked sufficient load-carrying ability and range. The S-58 is larger but retained the S-55's general layout. It has a larger engine and a four-bladed rather than a three-bladed main rotor that can be folded for ship-board storage. It could accommodate twice as many passengers as the S-55.

30 June 1952	USN contracts for S-58 prototype	2, p. 89; 36, p. 64
8 March 1954	First S-58 prototype flight	10, p. 292; 12, p. 89; 35, p. 173; 34, p. 255
	Preliminary production contracts already issued for the SH-34G Seabat by the time the first S-58 prototype is flown	2, p. 89

Date	Event	Source
20 September 1954	First production SH-34G flight	2, p. 89
August 1955	First operational delivery to HS-3 Squadron	2, p. 89; 3, p. 138

The USMC bought S-58s as utility transports (UH-34D Seahorse). The first USMC production order was 15 October 1954 with the first operational delivery occurring on 5 February 1957. The U.S. Army also purchased S-58s (CH-34A Choctaw). The first Army production order was placed in 1953 and the first delivery was in April 1955.

SH-60B SIKORSKY SEA HAWK LAMPS MARK III

- o Designed in response to Navy's Light Airborne Multi-Purpose System (LAMPS) Mk III requirement for a computer integrated ship/helicopter system optimized for antisubmarine warfare; in a secondary mission LAMPS Mk III performs antiship surveillance and targeting duties
- o Navy plans to procure 204 Sea Hawks based on Sikorsky's S-70 design, which is also used for the Army's UH-60A Black Hawk
- o Also developing SH-60F for close-in carrier-based operation

Milestone	Date	Event	Source
	February 1969	Project initiated	45; 56
A	April 1970	Requirement for manned helicopter aboard destroyers to enhance antiship missile defense (ASMD) and antisub warfare (ASW) capabilities	56
	March 1971	Program redirection	56
	December 1971	H-2 Seasprite conversion with ASW/ASMD avionics suite introduced into fleet	56
	June 1972	Complete initial test bed evaluation phase	45; 56
	29 June 1972	DSARC I/II, approved LAMPS I, continue LAMPS III program, return to DSARC after design review in January 1973	56; 47
	July 1973	DSARC IIA approves start of Mk III engineering development	47; 56
	April 1974	IBM selected as prime contractor	45; 56
	May 1976	DSARC IIB approves continued development and issuance of RFP for UTTAS-class helicopter airframe and engine	47; 56
	December 1976	Concept validation	56
	1 September 1977	S-70 selected by USN as the SH-60B LAMPS III helicopter to replace the SH-2F Seasprite. It differs from the UTTAS in having automatic rotor blade and tail rotor pylon folding, movement of the tail wheel further forward, Magnetic Anomaly Detection (MAD), and surface search radar. It can carry two Mk 46 torpedoes	36, p. 74; 45
	September 1977	Awarding of FSD sustaining engineering contracts (prototype)	56
B	28 February 1978	Development contract for five prototype SH-60B's received, FSD contract award, DSARC IIC	36, p. 74; 45; 47; 56

Milestone	Date	Event	Source
	March 1978	Approval for FSD	45
	30 August 1979	Rollout ceremony for prototype	45
	November 1979	First prototype delivery	45
	12 December 1979	First prototype flight of SH-60B Seahawk	38, p. 19; 56; 46, p. C-90; 45
	January 1980	LAMPS III system installed on USS McInerney	56
	February 1980	Formal ship/air weapon system demonstration successfully conducted	56
	May 1980	Total weapon system demonstration successfully conducted with a mission equipped SH-60B	56
	January 1981	First SH-60B lands aboard USS McInerney at sea	56
	September 1981	Limited production authorized	47
	April 1982	DSARC IIIB, decision for full-scale production	45
	April 1982	Initial production contract	45
	June 1982	DSARC III, production approved	47
	October 1982	Award of aircraft pilot production contract and full-scale production contract	45
C	March 1983	First production delivery	45

TH-55A OSAGE (Hughes Model 269A-1)

Date	Event	Source
1954-1960	Hughes commissions an extensive market research program that persuades management of a substantial market potential for light helicopters	2, p. 49
September 1955	Hughes begins development of a lightweight helicopter on its own for the commercial market	2, p. 49; 10, p. 236
October 1956	First prototype flight of Model 269	2, p. 49; 10, p. 236; 36, p. 41
1958	U.S. Army orders five Model 269As for tests as a light helicopter trainer	2, p. 49
July 1960	Hughes decides on commercial production of the Model 269A (an improved version of the Model 269)	2, p. 49
25 October 1961	First commercial delivery of production Model 269A	2, p. 49; 36, p. 41
Mid-1964	U.S. Army selects Model 269A-1 as a llight helicopter trainer	8, p. 362

UH-1A/B/D IROQUOIS (Bell Models 204/205)

- o Utility helicopter developed from XH-40 prototype
- o Used by more air forces and built in greater numbers than any other military aircraft since World War II
- o Early version seated 8 to 10 soldiers and carried an occasional machine gun

Milestone	Date	Event	Source
	1954	U.S. Army initiates design competition for a helicopter to perform general utility duties, front-line casualty evacuation, and instrument flight training	12
	June 1955	Bell wins design competition. U.S. Army orders three prototypes	2, p. 11; 12; 34, p. 244; 46, p. C-79
	22 October 1956	First prototype flight of the UH-1 (Model 204)	2, p. 11
	1957	U.S. Army orders six UH-1s for service testing	2, p. 11
	February 1958	First service test flight of UH-1	2, p. 11
	Early 1958	U.S. Army places first production order for the UH-1A. (The UH-1A is the first large-scale production version of the Iroquois series. It is generally similar to UH-1 prototypes with only minor changes.)	2, p. 11
	September 1958	First flight of production UH-1A	1/Part 2; 46, p. C-79
	1959	U.S. Army requests development of improved version of the UH-1A	2, p. 12
	June 1959	Development of improved version begins	2, p. 12
	30 June 1959	First delivery of production UH-1A	2, p. 11; 12; 36, p.29; 46, p. C-79
	1960	First deployment of the UH-1A	2, p. 11
	1960	First prototype flight of UH-1B	2, p. 12
B	July 1960	U.S. Army announces contract for seven test models of an improved Iroquois with larger carrying capacity and longer range at faster speeds, designated the UH-1D (Bell Model 205)	2, p. 12; 6, p. 266; 11, p. 208

Milestone	Date	Event	Source
	December 1960	U.S. Army issues first production order for the UH-1B	2, p. 12
	March 1961	First production delivery of UH-1B	2, p. 12; 10, p. 182
	16 August 1961	First prototype flight of UH-1D	2, p. 12; 6, p. 266; 11, p. 208
	1961	U.S. Army orders production of UH-1D	2, p. 12
	March 1962	U.S. Army flight testing of UH-ID begins at Edwards AFB	11, p. 209
C	May 1963	First delivery of production UH-1D	2, p. 12
	9 August 1963	First deployment of UH-1D (11th Air Assault Division, Ft. Benning)	6, p. 266; 36, p. 30; 10, p. 182; 11, p. 209

UH-1E IROQUOIS (Bell Model 204)

Milestone	Date	Event	Source
B	March 1962	Bell wins USMC design competition for an assault support helicopter with a variant of the UH-1B (differing mainly in equipment), designated UH-1E	2, p. 13; 6, p. 266
	February 1963	First flight of production UH-1E	10, p. 182; 11, p. 209
C	21 February 1964	First operational delivery of UH-IE (Marine Air Group 26, New River, NC)	6, p. 266; 10, p. 182; 11, p. 209

UH-1F/H AND HH-1H IROQUOIS (Bell Models 204/205A-1/205)

Milestone	Date	Event	Source
B	June 1963	Bell wins USAF design competition for missile site support helicopter with a variant to the UH-1B, designated UH-1F	30, p. 55; 10, p. 182
	June 1963	USAF first production order for 25 UH-1F's	6, p. 266; 11, p. 209
	20 February 1964	First test flight of UH-1F	31, p. 21; 24, p. 121; 6, p. 266; 10, p. 182
C	September 1964	First production delivery of UH-1F (4486th Test Squadron, Eglin AFB)	6, p. 266; 10, p. 182; 24, p. 121; 11, p. 209
	September 1967	First production delivery of the UH-1H (Bell Model 205A-1, similar to the UH-1D with a larger engine and ordered as replacement to the UH-1D)	7, p. 237; 36, p. 30
	4 November 1970	USAF issues fixed-price contract for 30 local base rescue helicopters, designated HH-1H (the same as the UH-1H Bell Model 205, but with different equipment)	6, p. 266; 24, p. 121

UH-1N IROQUOIS (Bell Model 212)

Milestone	Date	Event	Source
B	1 May 1968	Bell announces receipt of a development contract from the Canadian government for a twin-engine version of the UH-1H (uses the UH-1H airframe but has twin turbines and advanced avionics), designated UH-1N (Bell Model 212)	6, p. 271; 24, p. 121
	19 September 1969	Bell announces production order from Canadian government for the UH-1N	6, p. 271; 24, p. 121
	September 1969	USAF orders 79 UH-1N's, USN orders 40 UH-1N's, and USMC orders 22 UH-1N's	6, p. 271; 24, p. 121
C	September 1970	First delivery of UH-1N to USAF	6, p. 271
	April 1971	First delivery of UH-1N to USMC	6, p. 271
	Late 1971	First delivery of UH-1N to USN	6, p. 271
	1972	First delivery of HH-1H to USAF	24, p. 121

UH-2 SEASPRITE

Date	Event	Source
1956	Kaman wins USN design competition for a fast long-range utility helicopter. Its primary role is search and rescue. Other duties include all-weather carrier guard duty, gunfire observation, courier duty, personnel transfer, reconnaissance, tactical air controller, and medical evacuation. It is to have emergency flotation capability.	2, p. 55
29 November 1957	USN order four test models and 12 production models, designated UH-2	2, p. 55
2 July 1959	First test flight	2, p. 55; 10, p. 241; 34, p. 250; 36, p. 45
18 December 1962	First delivery of production version, designated UH-2A	2, p. 55; 9, p. 250; 10, p. 241; 11, p. 278; 36, p. 45; 45
4 June 1963	First shipboard service (aboard the USS Independence)	3, p. 142; 10, p. 241; 11, p. 278
8 August 1963	First shipboard delivery of the UH-2B (aboard the USS Albany). Developed from the UH-2A for visual flight rules (VFR) conditions, it differs only in its electronic navigational equipment	6, p. 364; 3, p. 142; 10, p. 241; 11, p. 278; 36, p. 45
2 January 1964	Kaman announces receipt of USN contract to add special rescue equipment to the UH-2A and UH-2B. The converted model is designated UH-2C	10, p. 241; 11, p. 278
March 1965	First conversion to the UH-2C configuration completed	3, p. 142
August 1967	Deliveries of converted UH-2C models begin	6, p. 364; 8, p. 366
February 1970	First operational delivery of the HH-2D, an armed and armored twin-engine development of the UH-2C. Its primary mission is the search and rescue of downed pilots	6, p. 364
October 1970	USN awards Kaman a contract for modifying 10 HH-2Ds to the interim LAMPS (Light Airborne Multi-Purpose System)	6, p. 364

Date	Event	Source
	configuration for antisubmarine warfare and antiship missile defense duties, designated the SH-2D LAMPS modifications involve (1) installation of Canadian Marconi LN 66 high-power surface radar in a glassfibre honeycomb dome under the chin; (2) ASQ-81 MAD deployed by winch from a pylon on the starboard side of the fuselage; (3) 15 AN/SSQ-47 active or AN/SSQ-41 passive sonobuoys launched by a small explosive charge from a removable rack on the port side; (4) ALR-54 electronic support measure; (5) 8 Mk 25 marine flares/smoke markers; (6) data link; (7) tactical navigational system and associated communications and control units, recorders, displays and antenna; (8) auxiliary fuel tanks hardened for launching Mk 44 and Mk 46 ASW homing torpedoes	
16 March 1971	First flight of the SH-2D	6, p. 364; 36, p. 45
July 1971	Additional 10 conversions ordered	6, p. 364
7 December 1971	First operational deployment, SH-2D	6, p. 364; 36, p. 45
March 1972	All 20 conversions completed	6, p. 364
February 1973	First USN contract for SH-2F LAMPS, an improved version of the SH-2D. It has a new rotor developed under joint USN-Kaman funding that increases performance in terms of reliability and maintenance through elimination of most of the vibration. It also has a shorter wheelbase, stronger landing gear, improved navigational and communications equipment, and new engines. The USN plans to convert all HH-2s and SH-2Ds to the SH-2F configuration	6, p. 364
May 1973	First delivery of converted SH-2F	6, p. 364; 7, p. 322
11 September 1973	First operational deployment of the SH-2F	6, p. 364; 7, p. 322

UH-60 (UTTAS) BLACKHAWK (Sikorsky S-70)

Although improved performance (over that of the UH-1 series) was one goal of the U.S. Army's Utility Tactical Transport Aircraft System (UTTAS), more important was minimizing lifetime cost by enhancing reliability, availability, and maintainability (RAM). Believing that reliable RAM statistics could be generated only by using full-scale production prototypes, and believing that performance requirements could be met with available low-risk technology, the service initiated the program as a full-scale development; the UTTAS program began with DSARC II and ended with a production decision. To generate statistically significant RAM figures before making a production commitment, the Army hoped to take six full-scale prototypes from each of two competing contractors through a total of 11,360 flight test hours. Although subsequently abbreviated by the Congress, the approved program still involved several thousand hours of aircraft and engine testing over two years.

Milestone	Date	Event	Source
	July 1968	Concept formulation	12; 45
	August 1968	First study contracts awarded	12; 45
A	13 May 1971	DSARC I approves modification of service proposal	45; 47
	22 June 1971	Blackhawk approved for full-scale development. (DEPSECDEF, on the DSARC recommendation, signs Decision Coordinating Paper No. 13.)	40, p. 3; 9, p. 31
	July 1971	Engine RFP issued	5, p. 32
	5 January 1972	Airframe RFP issued	5, p. 32; 45
	6 March 1972	Engine development contract awarded to General Electric Company	40, p. 3; 58
	31 March 1972	Airframe proposals received	40, p. 3
B	30 August 1972	Airframe prototype development contracts awarded to Sikorsky and Boeing-Vertol	5, p. 32; 58; 36, p. 74; 45; 40, p. 3
	17 October 1974	Sikorsky first prototype flight	5, p. 21; 32, p. 22; 36, p. 74; 46, p. C-90; 45
	29 November 1974	Boeing-Vertol first prototype flight	5, p. 21; 45; 33, p. 21; 58
	20 March 1976	Three prototypes from each contractor accepted by the U.S. Army	40, p. 6
	March 1976	Government fly-off begins	40, p. 6; 36, p. 74
	31 August 1976	Sikorsky ground test vehicle delivered	40, p. 6

Milestone	Date	Event	Source
	1 September 1976	Boeing-Vertol ground test vehicle delivered	40, p. 6
	30 November 1976	DSARC III approves production of 200 a/c	47
	23 December 1976	Sikorsky wins production contract with 12 helicopters ordered. Also receives option to produce up to 330 more UH-60's over three years	5, p. 41; 43, p. 4; 36, p. 74; 46, p. C-90; 45
	23 December 1976	GE awarded engine production contract for 53 T-700 engines	36, p. 74; 40, p. 6
	September 1978	First production unit rolls out	45
	October 1978	First flight of production UH-60A	39, p. 22; 46, p. C-90
C	31 October 1978[1]	First production delivery of UH-60A UTTAS to U.S. Army	40, p. 6; 58
	11 June 1979	Flight Development Test and Evaluation of UH-60A begins	40, p. 6
	October 1979	Full-scale production decision and contract	45
	November 1979	IOC	59, p. 31

[1]Reference 46, p. C-90, dates first delivery of a UH-60A in April 1979.

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Appendix C

MISSILES

AGM-53B-1 CONDOR

- o Air-to-surface missile (630-lb warhead) with stand-off range of 60 miles to be launched from Navy's A-6E/TRAM (Target Recognition and Multi-Sensor) aircraft to attack ships and shore installations
- o TV-guided; pilot fires, leaves area, acquires target on radar, switches to missile's TV for terminal guidance
- o Cancelled because of higher cost and lack of all-weather capability versus guided bombs and vulnerability of data link; also concern that stand-off range is too short

Milestone	Date	Event	Source
A	June 1966	Award contract for Phase II engineering development to Rockwell (initially started work in 1963)	67
	October 1967	Initial launch	68
	March 1970	First powered flight	68
	April 1971	Prototype RDT&E contract award	67
B	August 1973	DSARC II review	68
	October 1973	Pilot production contract award	67; 68
	August 1974	Accept first pilot production award	67
	June 1976	DSARC IIB authorizes limited production	67
	September 1976	Program terminated by Congress	67; 68

AGM-65A/B MAVERICK

- o Original TV-guided version of short-range air-to-surface missile designed for high-probability kill capability against hard targets
- o Can be launched at altitude over the target or at long slant ranges; daylight operation only
- o Launch and leave capability; range of 5 miles; 125-lb warhead
- o B version has improved optics section for target scene magnification

Milestone	Date	Event	Source
	April 1964	Tactical missile office formed at Wright-Patterson AFB to study AF needs for small, medium, and large missiles	2, p. 5-2
	15 July 1964	SOR 215 issued for three missiles; Maverick is the medium-sized missile	1; 2, p. 5-2
	December 1965	TAGM-65 concept approved	2, p. 5-2
A	7 June 1966	Concept formulation started	1
	December 1966	RFP for concept definition	2, p. 5-2
B	10 July 1968	Contract definition completed, contract awarded for TPP	1; 2, p. 5-2; 69
	3 September 1968	DCP approved	1
	3 March 1969	Preliminary design review	1
	1 August 1969	Category I flight test begins	1; 2, p. 5-2; 3
	15 May 1970	Critical design review	1
	22 December 1970	Preliminary configuration inspection	1
	16 January 1971	Category II flight test begins	1; 2, p. 5-2; 3
	February 1971	First category two launch	2, p. 5-2
	June 1971	DSARC III, approved for production	1; 4
	July 1971	Exercise date of Option A for production of 2000 missiles	2, p. 5-2; 3
	26 November 1971	Category II flight test ends	1
	1 September 1972	Engineering development ends	1
	September 1972	Approve procurement of Option B as proposed by services	4
C	December 1972[1]	Delivery date of first production missile	1

Milestone	Date	Event	Source
	15 February 1973	IOC	1; 3; 69
	24 July 1973	First Article Configuration Inspection (FACI)	1

[1]Reference 3 dates first delivery of Option A missiles in September 1972.

AGM-65D/G IIR MAVERICK

- o Infrared guidance for day/night and adverse weather operation; produces TV-like picture on the cockpit display
- o G version carries 300-lb warhead

Milestone	Date	Event	Source
A	November 1973	RFP for advanced development	2, p. 5-7
	April 1974	Concept definition begins	2, p. 5-7
	July 1975	RFP for FSD phase	2, p. 5-7
	June 1976	Development contract awarded to Hughes	2, p. 5-7
	September 1976	DSARC II approves transition into FSED	2, p. 5-7; 10; 13; 4
B	October 1978	Engineering development contract, FSED contract	2, p. 5-7; 10; 13; 14, p. 19
	August 1979	Single rail launcher production award	10
	June 1980	First flight, joint DT&E and IOT&E flight testing	2, p. 5-7; 13
	July 1980	Initiate OT&E/IOT&E	10
	March 1982	DSARC IIIA (pilot), preparation for low-rate production approved	2, p. 5-7; 4
	August 1982	DSARC IIIB full production	2, p. 5-7
	September 1982	Low-rate production approved (pilot)	4; 10
	April 1983	DSARC III approves phased production, reduced rate production	4; 10
C	October 1983	Delivery of three pilot production models	10; 15, p. 18
	June 1985	Full-rate production decision	10

AGM-69A SRAM

- o Nuclear tipped air-to-surface missile carried by the B-52 to suppress air defenses during penetration; 100 mile range

Milestone	Date	Event	Source
A	24 April 1963	Hq USAF issues ADO 51 for all-weather, tactical air-to-surface missile	1
	- August 1963	USAF publishes draft SOR on SRAM	5
	18 March 1964	SOR 12 issued	1
	23 March 1965	Secretary McNamara approves the initial development of SRAM	6
	29 April 1965	Hq USAF issues System Definition Directive ZAGM-69A, which formally authorizes initiation of project definition	1
	28 July 1965	Hq USAF approves release of RFP to industry for Phase I	1
	30 July 1965	RFP released	1
	30 August 1965	AF receives SRAM definition proposals from five contractors	1
	2 November 1965	AF announces that Martin-Marietta and Boeing win Phase I competition	1
	2 September 1966	Contractor completes Phase I tasks	1
B	31 October 1966[1]	Secretary of the AF announces Boeing as Phase II contractor	1
	7 November 1966	Boeing awards propulsion contract to Lockheed Propulsion Co.	1
	21 November 1966	Acquisition contract awarded to Boeing	1
	6 December 1967	First dummy missile dropped	1
	1 April 1968	SecDef approves Development Concept Paper 51 for the AGM-69A program	1
	1 August 1968	AF begins FB-111 SRAM Category I flight testing	1
	July 1969	First powered launch	1
	9 July 1969	Contractor launches first SRAM from a B-52 carrier	1
	26 January 1970	DoD approves 1,900 missile procurement program on an incremental basis	1

Milestone	Date	Event	Source
	June 1970	Long-lead production authorized	1
	5 December 1970	DoD approves SRAM production	1
	12 January 1971	Hq USAF awards a contract to Boeing for SRAM production	6
C	1 March 1972	First production SRAM delivered to SAC	6
	August 1972	AF activates first B-52 SRAM squadron, IOC	1; 69
	12 January 1973	Procurement reduced from 1,900 to 1,500	1

[1]Reference 69 gives development start in December 1966.

AGM-84A HARPOON

- o All-weather antiship missile that can be launched from air (P-3, A-6, F/A-18, B-52G), surface (FF-1052, DDG, DD-963/993, CG, CGN, PHM, BB and FFG-7 class ships), and nuclear attack submarines (SSN-594, SSN-688, and SSN-637)
- o Uses active radar seeker, radar altimeter, and attitude reference assembly in conjunction with small digital computer for missile guidance and control
- o Turbojet powered and subsonic with 120 mile range (air-launched)

Milestone	Date	Event	Source
A	November 1970	DSARC I, approved to completion of design phase	4
	June 1971	McDonnell Douglas selected as prime contractor to develop Harpoon	10
	February 1972	First flight	10
	July 1972	Engine contractor selected	10
	May 1973	DSARC IIA approves program	4
B	June 1973	FSD start date	17; 69, p. 31
	March 1974	First prototype flight	17
	June 1974	DSARC III, approval of pilot production and procurement	4
	June 1975	DSARC IIIA approves low-rate production	4
	August 1975	Start of OPEVAL (missile)	16
C	February 1977	Accept first production missile	16
	July 1977	First delivery to fleet, IOC	16; 69, p. 31

AGM-86B ALCM

- Long-range strategic nuclear missile to be employed on late model B-52's and B-1B bombers to suppress defenses and to attack primary targets
- Range of 1,500 mi and warhead yield of 200 kt
- B-52H can carry 12 externally and 8 internally; B-1B can carry 14 externally and 8 internally
- Uses inertial guidance and terrain contour matching (TERCOM) to achieve accuracy of 100 feet

Milestone	Date	Event	Source
	August 1968	Subsonic Cruise Armed Decoy (SCAD) concept	2, p. 5-35
	July 1972	Boeing awarded initial SCAD contract	2, p. 5-36
	March 1973	DSARC II meeting, FSD not approved for SCAD	4
	June 1973	Terminate engineering development and reorient SCAD to a technology program	4
	July 1973	SCAD cancelled	2, p. 5-36
	February 1974	Stop work order rescinded	2, p. 5-36
A	February 1974	DSARC I	4; 10
	July 1974	Limited ALCM go-ahead authorized	2, p. 5-36
	December 1974	DSARC II, retained in advanced development	2, p. 5-36; 4;
	March 1975	DSARC IA approves restructured ALCM/SLCM programs for advanced development with common milestones	4; 10
	September 1976	First guided flight	10; 17
B	January 1977	DSARC II approves FSED 10	2, p. 5-36; 4;
	September 1977	Competitive fly-off between Boeing's AGM-86 and GD's AGM-109 announced	2, p. 5-36;
	February 1978	Both contractors awarded FSD contracts	2, p. 5-36;
	August 1978	Pilot production options with both contractors exercised in August 1978 to produce missiles for fly-off	2, p. 5-36;
	June 1979	First FSD fly	10
	March 1980	Boeing identified as fly-off winner, ALCM production initiated under fixed price incentive contract	2, p. 5-36; 10
	April 1980	DSARC III, production decision	2, p. 5-37; 10
	January 1981	Delivery of 2 preproduction missiles	17

Milestone	Date	Event	Source
C	April 1981	First production delivery	19
	September 1981	Full alert capability: 12 missiles on B-52	10
	November 1981	Rollout of first full-production missile	17; 18
	December 1982	IOC	17

AGM-88A/B HARM (HIGH-SPEED ANTI-RADIATION MISSILE)

- Air and surface launched anti-radiation missile designed to destroy ground-based surface-to-surface and surface-to-air missile system radars
- The Tactical Air Armament Study of 1969 described serious deficiencies in the then-current ARM missiles and recommended a new high-speed missile
- Solid rocket powered, Mach 2.0 plus speed, 25 mi plus range

Milestone	Date	Event	Source
A	June 1972	Decision Coordinating Paper (DCP-93) authorizes development	10
	May 1974	Texas Instruments awarded contract	10
	November 1974	Advanced development contract	10
	January 1977	DSARC II delays entry into FSED	4
B	February 1978	DSARC IIC, FSD approved	4; 10
	April 1979	FSED contract	10; 20
	April 1979	First flight FSED missile	20
	July 1980	DSARC IIB	10
	March 1982	DSARC III production approval	4
C	December 1982	First production delivery	10
	March 1983	DSARC III	10

AGM-114A HELLFIRE

- o Laser-guided, terminal-homing, modular missile system using a shaped charge to destroy tanks at range of 6+ miles
- o Can home in on target illuminated by ground or scout helicopter laser designator
- o Greater stand-off range and lethality than TOW

Milestone	Date	Event	Source
	1971	Exploratory development	10
	1972	Concept formulation	10
A	December 1972	Requirement issued and SPO established	21
	June 1974	Advanced development contract	21
B	February 1976	DSARC II, approve entry into FSD, use Hellfire on Advanced Attack Helicopter (AAH)	4; 10; 22
	March 1976	Deputy Secretary of Defense memorandum	22
	October 1976	FSD contract	10; 22
	October 1978	First launch on Cobra helicopter	10
	March 1982	Laser Hellfire production approved and contract awarded	10
C	July 1983	Missile and launcher availability	10
	January 1985	IOC on AH-64	10

XAGM-131A ADVANCED AIR-TO-SURFACE MISSILE (AASM, SRAM II)

- o Improved version of SRAM designed for B-1B to attack primary strategic targets or destroy air defenses
- o Improvements include new rocket motor to solve age related problems, higher velocities to increase survivability, increased range, new guidance for accuracy at extended ranges, new shape and design to reduce observability, and new warhead with modern safety features
- o Existing components used to minimize risk and development time
- o Speed in excess of Mach 3.5 and 300 mile range (3 times that of SRAM)

Date	Event	Source
July 1983	Defense Resources Board approves SRAM II new start	10
August 1983	JMSNS	4
FY 1985	SRAM II/AASM development begins	10
February 1985	System concept definition contract, system concept paper	10; 11, p. 24; 12
April 1986	RFP for SRAM II FSD	10; 12
December 1987	FSD contract award scheduled	10

AIM-7A SPARROW I

- o Semi-active radar-beam-guided medium-range (5 miles) air-to-air missile
- o 2,000 A version Sparrows were produced by Sperry Gyroscope in 1950's
- o 100 AIM-7B Sparrow 2 missiles, similar to Sparrow 1 but of larger volume, were produced by McDonnell Douglas in 1950's; program terminated in 1956

Date	Event	Source
January 1949	Navy sponsors development of Sparrow I	2, p. 5-42
January 1951	Navy sponsors development of semi-active seeker by Raytheon, Sparrow III	2, p. 5-42
January 1956	Enters limited production	2, p. 5-42

AIM-7F SPARROW III

- o Raytheon began AIM-7C Sparrow 3 development in 1956 using continuous-wave semi-active radar homing guidance; 2000 procured
- o AIM-7D Sparrow 3 was introduced soon after "C" version and included a prepackaged liquid motor; 7,500 were procured
- o AIM-7E Sparrow 3 (RIM-7H NATO Sea Sparrow), added folding wings to the "D" version, used extensively in Vietnam; 25,000 AIM-7E's were produced, 1,212 RIM-7H's are currently in U.S. service
- o AIM-7F Sparrow 3 included solid-state guidance and a more powerful motor (5,000 procured); 4,372 to be retrofit with advanced monopulse seeker developed for AIM-7M

Milestone	Date	Event	Source
	December 1965	Development initiated as product improvement to AIM-7E	2, p. 5-50; 23
A	July 1966	Development contract awarded to Raytheon	2, p. 5-50; 23
	March 1968	1st missile firing	23
	1969	AIM-7E production begins	10
	August 1969	DT&E testing initiated	2, p. 5-50
	July 1970	First preproduction missile delivered	2, p. 5-50; 23
	January 1972	IOT&E initiated	2, p. 5-50; 10
	1973	AIM-7E production ends	10
B	27 February 1973	DSARC II approved, plan to procure missiles for T&E using procurement funds	4
	1 October 1974	DSARC III approves production of 600 missiles for FY75, directing incorporation of new action fuze in production and the acceleration of competitive development of new seeker	2, p. 5-50; 10; 4; 23
	31 October 1974	FY75 production contract award	10
	April 1975	Complete active fuze development T&E	10
	July 1975	Complete active fuze OT&E	10
	September 1975	Active fuze production decision	10
C	January 1976	First production missile delivered	2, p. 5-50; 23
	April 1976	IOC, 1st delivery to fleet	23

AIM-7M SPARROW III

- o Incorporates new low-altitude-capable active fuze and a new monopulse target seeker featuring improved missile guidance performance in electronic countermeasures and clutter environment
- o Mach 2.5 maximum speed, 24+ n mi range, solid rocket powered, 510-lb launch weight
- o Inventory objective of 4,331

Milestone	Date	Event	Source
A	1 October 1974	AIM-7F DSARC III directs development of monopulse seeker	2, p. 5-55
	January 1975	Competitive start of development (parallel with 7F) for improved (monopulse) seeker	10
	August 1976	Select seeker contractor for pilot production	10
B	April 1978	DSARC II	2, p. 5-55; 4; 24
	April 1979	DCP 89B approves AIM-7M program	2, p. 5-55; 24
	October 1979	FY80 budget includes procurement of 330 AIM-7Ms	2, p. 5-55
	November 1979	First deliveries of (T&E) AIM-7M missiles	10
	April 1980	Contractor Development Test (CDT)	10
	April 1980	Long-lead production decision	10
	June 1980	Joint AF/Navy DT&E testing initiated	2, p. 5-55
	August 1980	Joint Technical Evaluation (JTE)	10
	December 1980	IOT&E initiated	2, p. 5-55
	1981	AIM-7F production completed	10
	February 1981	IOT&E start for AIM-7M	10
	March 1981	Production go-ahead approved	25
	October 1981	DSARC III authorizes production	2, p. 5-55; 25
	June 1982	OT&E Phase II begins	10
	October 1982	Operational evaluation completed	10
	12 December 1982	DNSARC full-rate production decision	10
	December 1983	First flight fully configured missile	10

AIM-9A SIDEWINDER

- o Small, short-range air-to-air missile using infrared guidance
- o Developed in-house at China Lake, it is one of the most successful missiles ever developed, still in service 35 years after first test firing
- o A model prototype only

Milestone	Date	Event	Source
	1947	Naval Ordnance Test Station (NOTS) at China Lake surveys air-to-air homing devices	76, p. 106; 2, p. 5-41
	1948	NOTS completes analysis of fire-control systems for air-to-air rockets; concludes that putting guidance on missile is best way to reduce accuracy errors	76, p. 107
	1948	Laboratory models of infrared tracking device and hot-gas servo control valve are demonstrated at NOTS	76, p. 107
A	June 1949	W. B. McLean writes formal "Proposal for a Heat-homing Rocket"; Bureau of Ordnance officials direct further work to demonstrate untested principles, add some funding for fuzing development	76, p. 107
	spring 1950	Airborne detector detects a jet aircraft three-quarters of a mile away	76, p. 109
	1950	Demonstration of laboratory hot-gas control servo sufficiently advanced for use in a practical missile	76, p. 109
	March 1951	Two tests of sun-seeking, free-flight, ground-launched missiles demonstrate that the hot-gas servo could control missile in flight	76, p. 110
	autumn 1951	As a result of demonstrations NOTS group feels "technically certain that all problems were capable of solution if a full-scale program could be established"	76, p. 110
B	late 1951	Guided Missile Committee approves program and Bureau of Ordnance funds $3 million development program	76, p. 110
	1952	Airframe redesigned in response to free-flight and wind-tunnel tests	76, p. 111
	August 1952	First air firing of complete missile using Type B seeker that was later rejected	76, p. 111
	November 1952	First delivery of 30 custom-made missiles with Type A seekers	76, p. 111
	1952	Philco selected as prime contractor	76, p. 111

Milestone	Date	Event	Source
	1953	Satisfactory Type A seeker performance achieved and selected for missile	76, p. 111
	September 1953	First flight test AIM-9A	2, p. 5-41; 10
	1953	16 missiles fired at target drones demonstrating all components except fuze	76, p. 111
	December 1953	Bureau of Ordnance issues requirement and specifications	76, p. 111
	January 1954	Limited production authorized	2, p. 5-41
	March 1954	Philco production design is frozen	76, p. 111
	1955	Controlled-fragmentation warhead to be used in operational missile is completed	76, p. 112
	1955	88 missiles fired, including tests against jet targets	76, p. 112
C	January 1956	Missile released for Operational Development Force (OpDevFor) evaluation	76, p. 112

AIM-9B SIDEWINDER

- o Original joint AF/Navy production version with Mk 17 engine
- o 80,900 produced by Ford and Raytheon

Milestone	Date	Event	Source
B	January 1953	Full development initiated	2, p. 5-49
	September 1956	Production authorized	2, p. 5-49
	1957	Deliveries to fleet begin	2, p. 5-49

AIM-9L SIDEWINDER

- o AlM-9C was Navy version fitted with radar guidance; about 2,000 built by Motorola but withdrawn from service due to unreliability; used Mk 36 motor
- o AIM-9D was Navy IR-guided version of AIM-9C using new seeker and Mk 36 motor; 12,000 built by Ford; used to develop Chaparral
- o AIM-9E was Air Force version using Peltier cooling for seeker; about 5,000 produced, mainly by rebuilding older AIM-9Bs
- o AIM-9G was improved Navy version of AIM-9D with new SEAM seeker; 2,120 built
- o AIM-9H was derivative of AIM-9G for Navy implementing solid state electronics; 7,700 built
- o AIM-9J was Air Force version based on rebuilt AIM-9B and AIM-9E models using some solid-state components; had higher acceleration than earlier models; 10,000 built
- o AIM-9L was joint AF/Navy type using new seeker for a frontal attack capability; uses new DSU-21 optical fuze
- o L version has weight of 190 lb, length of 9 ft 5 in., speed of 1650 mph, and is powered by a Mk 36 Mod 7 or 8 solid propellant rocket motor

Milestone	Date	Event	Source
A	October 1970	OSD issues guidance approving requirement for new infrared missile	2, p. 5-57
	June 1971	Engineering development begins on AIM-9L, DCP 90 authorizes FSD	10; 2, p. 5-57
B	August 1971	FSD initiated	2, p. 5-57; 26
	July 1972	First flight of prototype	2, p. 5-57
	August 1972	First missile firing	26
	May 1973	Delivery of first preproduction model	26
	July 1973	Engineering test phase completed	10
	May 1974	Development, test, and evaluation completed	10
	August 1974	Joint technical evaluation begins	10
	March 1975	Joint technical evaluation completed	10
	29 January 1976	DSARC III authorizes low-rate production, but full-rate production will commence only after satisfactory demonstration of reliability and maintainability (R&M)	2, p. 5-57; 4; 27
	February 1976	DSARC III initial production decision memo	10
	April 1976	Award first production contract	26
	April 1978	Full production authorized	2, p. 5-57; 4; 27; 10
	1981	Production complete	10

AIM-9M SIDEWINDER

- o Replaces 9L as the standard type incorporating a significantly improved anti-air countermeasures capability, a reduced smoke engine, and a closed cycle cooler

Milestone	Date	Event	Source
B	February 1976	Start of FSD on AIM-9M	28; 10
	February 1976	AIM-9L improvement program initiated	2, p. 5-57
	November 1977	AIM-9M program enters FSD	2, p. 5-57
	February 1978	First flight prototype missile	2, p. 5-57; 28
	March 1978	Improved missile designated AIM-9M	29
	March 1979	Engineering development completed	10
	February 1981	Development completed	2, p. 5-57
	May 1981	Production authorized	2, p. 5-57

AIM-54A PHOENIX

- o Radar-guided air-to-air fleet air defense missile effective against multiple high speed, high and low altitude, maneuvering targets at long range (2.1 n mi minimum range, 72.5 n mi maximum range)
- o System consists of long-range airborne weapon control system (AN/AWG-9) with multiple target handling capabilities (up to 24 hostile targets) and long-range missiles (6 missiles can be carried on an F-14) that can be fired almost simultaneously in an all-weather and heavy jamming environment
- o 2,932 purchased

Milestone	Date	Event	Source
	1960	Concept outlines	30
B	December 1962	Development contract awarded to Hughes, initiate development	31; 69
	1965	Flight testing begins	10
	May 1966	First guided flight	10; 31
	September 1966	First successful intercept	30
	September 1969	Simultaneous attack capability demonstrated	30
	December 1970	Production contract award	10
	December 1971	First production contract	31
	February 1972	First delivery pilot production missile	31; 32
C	March 1973	First delivery of full production missile	31; 32
	December 1973	Fleet introduction on F-14A, IOC	31; 69

AIM-54C IMPROVED PHOENIX

- o Includes improved lethality, stream raid discrimination, ECCM performance, high and low altitude performance, and R&M
- o Faster speed than A version (Mach 5.0 versus Mach 4.3)
- o Inventory objective of 7,249

Milestone	Date	Event	Source
A	October 1976	Improvement program begins, full development go-ahead	10; 31; 30
B	February 1978	Hughes begins development, receives $41 million contract on Improved Phoenix	33, p. 15; 30
	August 1979	Engineering development model deliveries begun	10; 30
	July 1979	First engineering development firing	34, p. 73; 35
	October 1980	Pilot production decision	35
	December 1980	Complete engineering development	10
	October 1981	First production delivery (pilot)	10; 30
C	October 1982	Hughes makes first production model delivery	10
	January 1983	Full production approved	10
	January 1984	IOC	10
	15 May 1984	Navy decision to second source	10
	June 1984	Quality control problems detected at Hughes	10
	22 June 1984	Navy stops accepting deliveries	10
	August 1984	Navy stops progress payments to Hughes	10
	23 November 1984	QC plan accepted, payments resume	10
	February 1985	Deliveries resume	10
	April 1986	AIM-54C+ deliveries begin	10
	5 June 1986	Raytheon selected as second source	10

AIM-120A AMRAAM

- o All-environment active-radar-guided air-to-air missile designed to replace Sparrow in Navy and Air Force inventories
- o Improvements over Sparrow include a launch and leave capability, increased missile velocity, a larger performance envelope, simultaneous target engagements, better reliability, and much smaller size
- o Will be compatible with F-14, F-15, F-16, F-18, and appropriate NATO aircraft
- o AF requirements for 17,217, Navy requirements for 7,257, and export plans for 6,000

Milestone	Date	Event	Source
	October 1975	Tactical working group convened by USDR&E to study AF and Navy requirements for air-to-air weapons and JSOR issued for advanced air-to-air missile	2, p. 5-43
	July 1976	Congress directs development of new missile	2, p. 5-43
	October 1976	Five contractors receive contracts and undertake concept definition studies	2, p. 5-43; 10 36, p. 25
	August 1978	RFP for validation phase	2, p. 5-43
	September 1978	Design definition contracts	10
A	November 1978	DSARC I conducted	2, p. 5-44; 4; 37; 10
	January 1979	MENS approval authorizes program to proceed into validation phase	10; 2, p. 5-44
	February 1979	Contract awarded for validation phase to include ten prototype missiles each from Hughes and Raytheon	37; 10; 2, p. 5-44
	November 1979	Test program initiated	2, p. 5-44
	June 1980	First flights of the competing prototypes	2, p. 5-44
	November 1980	Flight testing begins	10
	April 1981	Determinations and Findings submitted	2, p. 5-44
B	December 1981	FSD contract awarded to Hughes	37; 10; 2, p. 5-44
	September 1982	DSARC II, continue FSD	37; 10; 4; 2, p. 5-44
	November 1982	SecDef Memorandum	37
	March 1984	FSD flight tests start	10
	June 1984	First production option expected to be exercised	2, p. 5-44

Milestone	Date	Event	Source
	December 1984	First flight production version, unguided missile	10; 38, p. 105
	August 1985	Second guided flight	39, p. 76
	1987	First production delivery planned	10

ANTI-SUBMARINE WARFARE (ASW) STANDOFF WEAPON (SOW) SEA LANCE

- o Designed to replace SUBROC as long-range missile used by submarines against other submarines
- o Will be launched from deep depths, will exit surface and fly supersonically to a computer-designated launch point, where it will jettison either a nuclear depth charge or the Mk 50 Advanced Lightweight Torpedo
- o 20 ft long, 3,100 lb, and range of 60 m versus 5 m for SUBROC
- o Inventory requirement for 1,052 on attack submarines

Milestone	Date	Event	Source
	October 1979	Initiated advanced development	10
	4 January 1980	MENS approved	10
	February 1980	Concept formulation contracts awarded	10
A	April 1981	Validation phase contract to Boeing	10
	December 1982	DSARC I, demonstration and validation phase approved	4; 10
B	June 1986	DSARC II, authorizes completion of Phase II of advanced development	10
	30 July 1986	$380 million FSD contract to Boeing	40, p. 29; 10
	July 1989	Milestone IIIA long-lead production approval	10

HGM-16 ATLAS

- o First ICBM to enter development
- o Three engine liquid fuel design with a single nuclear warhead
- o 225 produced
- o A, B, and C versions for testing only

Milestone	Date	Event	Source
A	January 1951	Initial work begins on studies and subsystems for ICBM's	2, p. 7-3; 41, p. 58
	May 1952	Atlas project officially established	41, p. 58
	September 1952	Requirement identified	2, p. 7-3
	December 1954	Atlas configuration approved	42, p. 151
	January 1955	Validation effort begins, formal development contract with Ramo-Wooldridge and Convair	2, p. 7-3; 41, p. 58
	June 1957	Unsuccessful Atlas-A launch	41, p. 58; 43
B	December 1957	FSD begins on Atlas-D	2, p. 7-3
	December 1957[1]	First successful flight, third attempt	41, p. 92; 43
	April 1959	First successful flight of Atlas-D	2, p. 7-3
C	October 1959	First production Atlas-D delivered	2, p. 7-3; 43
	April 1960	IOT&E testing initiated	2, p. 7-3
	January 1961	FSD ends on Atlas-D	2, p. 7-3

[1]Reference 42, p. 151, gives first successful flight in November 1958; this probably refers to the first successful Atlas-B launch, which Ref. 43 dates in August 1958.

BGM-71A/C TOW AND I-TOW

- o Tube-launched, optically tracked, wire-guided (TOW) missile used to attack tanks from the air and ground
- o The C version added an extensible probe to increase the stand-off range of the 5-inch warhead
- o Propelled by two Hercules K-41 solid rockets
- o 224,478 TOW missiles of all types purchased by Army
- o Bought 30,940 Improved TOW warheads for modifications

Milestone	Date	Event	Source
A	October 1962	Basic research and development contract	44
B	November 1965	FSD contract	44
	1968	Initial production (prototypes)	10
C	September 1970	Introduction into inventory, IOC	10; 44
	August 1979	Engineering change proposals incorporated for I-TOW	44
	June 1981	First I-TOW production deliveries	44

BGM-71D TOW II

- o Uses 6-inch warhead with extensible probe
- o Microprocessor provides greater flexibility in guidance programming
- o Motor uses improved propellant to provide 30 percent more impulse
- o Bought 9,490 TOW II warheads and will modify 6,512 launchers to TOW II configuration

Milestone	Date	Event	Source
B	August 1979	TOW II research and development contract	44
	December 1981	Engineering change proposals incorporated for TOW II	44
C	September 1983	First production deliveries of TOW II	44

BGM-109G GROUND-LAUNCHED CRUISE MISSILE (GLCM) TOMAHAWK

- o Surface-to-surface theater nuclear missile with 1,500 mi range powered by F-107 turbofan engine with cruise speed of 550 mph
- o Inertial navigation with terrain contour updating is used to achieve CEP of 100 ft
- o A GLCM unit includes four transporter erector launchers (TEL), each capable of launching four GLCMs, and two launch control centers (LCC) connected by fiber optic data links; the TEL and LCC can be transported by C-141, C-130, and C-5 cargo aircraft
- o 573 to be deployed in Europe

Milestone	Date	Event	Source
B	January 1977	DSARC II, start of program	10; 45, p. vii
	May 1980	First FSD flight (from launcher but without launch control center)	10; 46; 47, p. 64
	February 1982	First GLCM delivered to Air Force by General Dynamics for flight tests	47, p. 63
	February 1982	First full launcher and missile flight, first operational platform launch	10; 48, p. 9
	May 1982	IOT&E begins (first flight)	10; 49
C	August 1982	First production delivery	53
	November 1983	First missiles arrive in England	50, p. 20
	December 1983	IOC	10

BGM-109 SEA-LAUNCHED CRUISE MISSILE (SLCM) TOMAHAWK

- Produced in three versions: TASM (Tomahawk anti-ship missile) with 1,000-lb unitary Bullpup warhead, TLAM-C (Tomahawk land-attack missile/conventional) with Bullpup warhead and TLAM-N (Tomahawk land-attack missile/nuclear)
- TASM uses modified Harpoon guidance system and the AN/DPW-23 active radar seeker for terminal homing for a range of 250 miles
- TLAM-C uses TERCOM-updated inertial guidance with DSMAC (digital scene matching area correlator) for terminal guidance and has range of 700 mi from a ship and 500 mi from a submarine
- TLAM-N uses only the TERCOM-updated guidance and has range of 1,500 mi
- Requirements for 753 TALM-N, 593 TASM, 1,486 TLAM-C and 1,164 TLAM-D (submunition dispensers)

Milestone	Date	Event	Source
A	February 1974	DSARC I	4; 45, p. 5
	December 1974	DSARC II, continue in FSD	4
	March 1975	Approve restructured ALCM/SLCM program for advanced development with common milestones	4
	March 1976	First anti-ship missile flight	10
	June 1976	First flight and first guided flight for land-attack missile	10
	December 1976	First guided flight, anti-ship missile	10
	January 1977	First FSD fly, land-attack	10
B	January 1977	DSARC II	45, p. vii; 4
	February 1977	First FSD fly, land-attack missile	10
	May 1981	Initial delivery for OpEval scheduled	51, p. 21
C	July 1982	First production delivery	53
	November 1983	IOC of conventional land-attack; sub-launched missile fleet introduction	10; 52
	10 November 1984	First successful TLAM-C test with terminal dive attack	10

FIM-92A STINGER

- Designed to replace Redeye 2 in the man-portable air defense role by adding IFF and frontal attack capabilities
- Uses passive IR homing to lock on target
- The POST (Passive Optical Seeker Technology) seeker uses both infrared and ultraviolet tracking to enable the missile to lock on to the larger of two heat sources
- Army requirement for 50,878 (as of 30 June 1986), Marine Corps for 17,000, Navy for 685, and Air Force for 216

Milestone	Date	Event	Source
A	October 1967	Advanced concept definition begins	56; 10
	FY 1971	Advanced development begins	10
	May 1972	DSARC II, approve engineering development	4; 69
B	June 1972	FSD start	56
	August 1973	First launch tests	10
	28 June 1977	POST FSD effort begins with $39.5 million contract to General Dynamics	10
	November 1977	DSARC III	4
	April 1978	Full-scale production begins	10
C	September 1980	Delivery of first production missile	56
	April 1981	Initial production begins	10
	27 February 1981	Stinger deployment in Europe IOC	10; 69
	December 1983	Initial hardware availability for POST seeker	10
	April 1984	POST low-rate production	10
	July 1985	POST full-scale production	10
	July 1986	POST production proofing completed	10
	August 1987	First POST deliveries scheduled	10

GAM-72 QUAIL

- o Bulbous-nosed decoy cruise missile launched by the B-52 to aid penetration
- o 12 feet long and with a six foot wing span, the Quail used corner reflectors, Luneberg lenses, and barrage or rapid-sweep-through jammers to simulate the radar image of a B-52

Milestone	Date	Event	Source
	13 October 1952	SAC requirement forwarded to Hq USAF	7
	March 1953	GOR issued	1
A	October 1953	Development Directive authorizes Air Research and Development Center (ARDC) to start full development program	1
	November 1954	Source selection forwarded to Hq USAF	1
	April 1955	Development contracts awarded for Phase I (to mock-up)	1
	September 1955	Funding cut	1
	18 January 1956	Hq USAF issues GOR 139 for a short-range, air-launched missile, later designated Quail	6
B	1 February 1956	McDonnell selected for Phase II development	6
	November 1957	First glide launch	1
	August 1958	First powered flight	1
	31 December 1958	Letter contract for initial production lot awarded McDonnell	6
	1 March 1960	First successful powered flight of a prototype Quail missile	6
C	13 September 1960	First production Quail missiles delivered	6
	1 February 1961	First squadron operational	6

GAM-77A/B (AGM-23A/B) HOUND DOG

- o Long-range stand-off air-to-ground strategic-nuclear missile carried in pairs beneath the wings of B-52's
- o 960 km range; Mach 2 speed; 50,000 ft operational ceiling and 25 MT warhead
- o Uses inertial navigation system (INS) continuously updated by B-52's INS until launch
- o B version implemented improved navigational reliability and accuracy
- o 600 missiles produced

Milestone	Date	Event	Source
	15 March 1956	GOR 148 issued, calling for B-52 ASM; major contenders were Rascal and Regulus II	6
	June 1956	Proposals submitted by Bell and Vought for System 131A	1
	September 1956	System 131A canceled	1
	March 1957	North American submits initial proposal for a lightweight ASM	1
	April 1957	Draft revision of GOR 148 issued, emphasizing lightweight missile	1
	June 1957	New system specs issued, system designated 131B	1
	July 1957	Proposals submitted by firms	1
	July 1957	Navaho program canceled	1
	August 1957	Revised GOR formally issued	1
B	23 August 1957	North American Aviation selected; design start authorized	6
	October 1957	P&W J52 engine selected	1
	16 October 1958	Letter contract for first year's production	6
	December 1958	Rascal program canceled	1
	23 April 1959	First powered flight of a prototype Hound Dog	6
	August 1959	First guidance flight	1
	August 1959	150 hour test on engine completed	1
	Late 1959	First production autopilot used in flight test	1
C	21 December 1959	AF accepts first production missile, and delivers it to SAC same month	6
	September 1960	Negotiations on production start	1

Milestone	Date	Event	Source
	October 1960	Nuclear Weapons System Safety Board judges system safe for alert status and peacetime flying	1
	November 1960	Production rate ordered reduced to 17/month because of continuing reliability and performance problems	1
	January 1961	Announcement that B-52s at W-P AFB would be equipped with missiles in mid-1961	1
	June 1961	215 missiles delivered by end of June, at rate of 18/month	1
	June 1961	First missile delivered to Air Training Command	1
	September 1961	Last of 247 GAM-77 missiles delivered	1
	Late 1961	Fully satisfactory flight tests	1
	28 March 1963	Production of the Hound Dog missile completed	6

GAM-87 SKYBOLT

- o Long-range air-to-surface nuclear missile to alleviate the need for B-52 air defense penetration
- o Four would have been carried on B-52H
- o 1000 n mi range, 11,300 lb weight, 300 kT warhead
- o Canceled for technical and economic reasons

Milestone	Date	Event	Source
A	July 1957	RFP for missile to be launched from B-52; ballistic mode considered, but rejected because of long development time	1
	October 1957	System requirement #187, calling for an advanced air-to-air missile	1
	January 1958	One-year demonstration program starts	1
	March 1958	Contract to Martin for 4-missile flight test	1
	July 1958	Extend range goal of test vehicles, more test items added to Martin contract	1
	December 1958	Demonstration program completed; possibility of air-launching a ballistic missile proven	1
	January 1959	GOR 177 issued, development program for operational system authorized, RFP issued	1
	May 1959	Source Selection announced; DDR&E directs that initial work be limited to design studies	1
	July-October 1959	Major subcontractors selected	1
B	February 1960	OSD authorizes full-scale development	1
	December 1960	Development funds reduced, program stretched	1
	April 1962	First powered flight	1
	December 1962	Program canceled	1

GAR-1 (AIM-4) FALCON

- o Original small air-to-air radar-guided rocket developed by Hughes
- o Numerous modifications and designation changes

Milestone	Date	Event	Source
YGAR-1			
	7 November 1947	Requirement established	1
A	March 1947	Project initiated--study and development program for a small supersonic air-to-air guided rocket	
	June 1947	Project reduced to development of the semi-active radar seeker because of budget limitations	1
B	March 1948	Project reinstated as a complete missile development	1
	February 1949	Hq USAF directs that development of the fighter-launched guided aircraft rocket for offensive use have priority over the bomber-launched missile development	1
	May 1951	First YGAR-1 air launch	1
	January 1954	Service procurement of YGAR	1
C	November 1954	First production GAR-1s delivered	1
XGAR-1A			
	30 March 1955	GOR 84 issued	1
	12 May 1955	First XGAR-1A missile air-launched	1
	November 1956	Production of GAR-1 missiles terminated	1

IM-99A BOMARC

- ó Long-range surface-to-air nuclear missile designed to intercept targets before they reach the United States
- o Missiles guided by SAGE (Semi-Automatic Ground Environment) to the general area of the target where the missile's terminal homing guidance takes over
- o B version had range of 700 km and speed of 3,200 km/hr

Milestone	Date	Event	Source
	24 November 1949	Study begins under Hq USAF authority	1
A	January 1950	Air Materiel Command requests Boeing Airplane Company and the Aeronautical Research Center of the University of Michigan to make a cooperative study	8
	May 1950	Study completed; Boeing authorized to begin preliminary design	1
	22 September 1950	Military characteristics for missile are published	1
	31 December 1950	Boeing's preliminary design work completed	8
B	12 January 1951	AF contract authorizes development	8
	10 September 1952	First flight test	8
	August 1954	First successful flight (6th missile)	8
C	30 April 1959	Initial delivery date	1
	1 September 1959	Operational date	9
	September 1959	Category II test program held in abeyance because of inadequate test results	1
	February 1960	Testing resumes	1
	September 1960	Category II tests successfully completed	1

ATACMS and JTACMS (ARMY and JOINT TACTICAL MISSILE SYSTEM)

- o The ATACMS is a surface-to-surface semi-ballistic missile system that will be launched from the Multiple Launch Rocket System (MLRS) to deliver conventional, terminally guided submunitions or chemical payloads
- o Both missiles will attack forces beyond the range of cannon and rocket systems and have an immediate or direct impact on the close-in battle
- o The Army will also launch the Air Force JTACMS, probably a stealthy cruise missile, from MLRS

Milestone	Date	Event	Source
	April 1978	Assault Breaker technology assessment begins	10
	April 1981	MENS approved	10
A	July 1983	Assessment of JTACMS concept contracts awarded	10
	19 February 1986	DSARC I	10
B	26 March 1986	FSD contract award to LTV, ATACMS FSD start	10; 66
	FY 86	DSARC II planned	10

LGM-25C TITAN II

- o Major modifications of Titan I airframe, propulsion, guidance, reentry vehicle, and launch complex
- o 430,000 lb thrust first stage and a 100,000 lb thrust second stage fired at altitude
- o Range of 9000 miles
- o Uses storable fuel, an all-inertial guidance system rather than Titan I's vulnerable radio-guidance system, and a new, higher yield (nine MT) reentry vehicle (Mark IV)

Milestone	Date	Event	Source
A	September 1959	Secretary of the AF recommends approval of Titan II program	43
	November 1959	Air Force Ballistic Missile committee approves planning for a 14 squadron Titan force and development of the Titan II weapon system	43
	December 1959	USAF authorizes program	2, p. 7-9
	January 1960	Engine FSD begins	2, p. 7-9
B	May 1960	Development, test and production contract awarded	2, p. 7-9; 42, p. 155
	March 1962	First flight test completed successfully	2, p. 7-10; 43; 42, p. 155
C	December 1962	First missiles installed at Davis-Monthan AFB	2, p. 7-10; 43
	April 1963	First successful in-silo launch	2, p. 7-10
	March 1963	IOC at Davis-Monthan AFB	2, p. 7-10
	December 1963	All wings achieve IOC	2, p. 7-12
	April 1964	Last test flight, development ends	2, p. 7-10

LGM-30A/B MINUTEMAN I

- o Three-stage solid-propellent ICBM designed to deliver a single reentry vehicle with maximum range of 6,300 n mi guided by an all-inertial navigation system
- o Used first solid-propellent booster and an untried hot launch concept
- o Deployed in hardened, dispersed silos which are monitored by launch control centers manned by two officers (10 missiles per LCC)

Milestone	Date	Event	Source
	December 1955	Western Development Division initiates solid-propellent research and development program	2, p. 7-14
	February 1956	Study initiated on mobile ICBM	43
A	December 1956	Feasibility and validation studies of propulsion system begin	2, p. 7-14
	April 1957	WDD assigned responsibility for planning and management of solid-propellant ICBM	43
	September 1957	Assignment of special working group to develop "Weapons System O"--an idealized solid fuel missile	42, p. 158
	February 1958	HQ USAF authorizes Air Force Ballistic Missile Division to proceed with the start of research and development	2, p. 7-14; 43
	July 1958	Subcontractors selected	2, p. 7-14; 43; 42, p. 158
	August 1958	GOR 171 issued	43
	September 1958	Decision to sponsor complete system development	42, p. 159
B	October 1958	FSD begins, Boeing selected as missile assembly and test contractor for Minuteman	2, p. 7-14; 43
	September 1959	First full-scale MMI launched from silo (tethered)	2, p. 7-14; 43
	March 1960	Production commitments approved	41, p. 108
	February 1961	First MMI missile launch attempt is successful	2, p. 7-14; 43
	November 1961	First MMI missile launched from underground silo	2, p. 7-14
C	October 1962	First missile squadron turned over to SAC	2, p. 7-14

LGM-30F MINUTEMAN II

- o An upgraded version of the MMI: a new second stage with a single nozzle and secondary liquid injection for thrust vector control
- o Has increased range (8,300 n mi) and can store a larger number of targets in its inertial guidance system
- o The accuracy and payload capacity is substantially improved over MMI
- o 450 deployed

Milestone	Date	Event	Source
	March 1962	Initial planning/testing contract awarded to Boeing	2, p. 7-14
B	April 1962	Requirement defined FSD begins	2, p. 7-14
	August 1963	Production begins	2, p. 7-14
	October 1963	SOR issued	2, p. 7-14
	September 1964	First flight of test missile	2, p. 7-14; 43
	October 1965	IOC	2, p. 7-14
	December 1965	First operational configured MMII fired from underground silo, completes flawless flight	43
	March 1966	FSD ends, last MMII development missile launch at Vandenberg	2, p. 7-14
	August 1966	System operational	2, p. 7-14
C	7 December 1966	First production delivery to Wing 6 at Grand Forks	43

LGM-30G MINUTEMAN III

- o Improvement over MMI and MMII carrying a MIRV system of three warheads of either 200 kT or 330 kT each and an improved third stage motor using fluid-injection thrust-vector control providing finer control of movement and therefore better guidance (CEP of 400 meters)
- o The MIRV is essentially a fourth stage powered by a 135 kg thrust motor, maneuvered by six small pitch and yaw motors and four smaller roll motors; these motors are controlled by a fourth-stage guidance package which organizes the release of warheads, chaff, and decoys

Milestone	Date	Event	Source
A	December 1965	SecDef approves program	2, p. 7-23; 43
B	April 1966[1]	FSD begins; headquarters USAF SMD sets Minuteman III IOC for July 1969 and sets missile configuration and requirements	2, p. 7-23; 43
	August 1966	Contract for development and production of Improved Third Stage (ITS)	43
	August 1968	First FSD flight is successful	2, p. 7-23; 43
	July 1967	Production go-ahead for reentry vehicles	2, p. 7-23
	September 1969	SMD confirms Minuteman force of 1000 launchers and introduction of the MMIII by June 1970	43
C	June 1970	IOC, first flight of missiles turned over to 741st Strategic Missile Squadron	2, p. 7-23; 43; 69
	August 1970	System declared operational	2, p. 7-23
	December 1979	Deployment of larger warheads initiated	2, p. 7-23

[1]Reference 69 gives March 1968 as the date of development start.

LGM-118A PEACEKEEPER

- o ICBM with 6,000 plus n mi range, 400 ft CEP, and 10-12 500 kT warheads
- o A survivable basing mode is still being investigated

Milestone	Date	Event	Source
	November 1971	SAC submits ROC to HQ USAF	2, p. 7-27
	February 1972	ROC validated	2, p. 7-27
	May 1974	Concept definition phase initiated as an ADP	2, p. 7-27
A	March 1976	DSARC I authorizes entry into validation phase	2, p. 7-28; 4
	December 1978	DSARC IIA	2, p. 7-30; 4
	March 1979	DSARC IIB	2, p. 7-30; 4
B	June 1979	HQ USAF authorizes development of 92-inch MX missile, FSD start	2, p. 7-30; 62, p. 27
	September 1979	FSD of horizontal dash MPS basing mode is authorized	2, p. 7-30
	September 1980	Design review, MX Weapon System officially enters into preliminary design phase of development cycle	2, p. 7-32
	September 1981	President announces decision to base MX in existing silos while continuing to study long-term options through July 1984	2, p. 7-32
	November 1982	President announces closely spaced basing (CSB) for MX	2, p. 7-32
	June 1983	First flight	63
	August 1985	First silo launch	39, p. 19
C	August 1986	Installation of first operational missiles	40, p. 25
	December 1986	IOC (10 missiles)	10

MGM-52A LANCE

- o Highly mobile surface-to-surface battlefield nuclear or conventional missile designed to complement conventional divisional tube artillery
- o Uses simplified inertial guidance and is the first U.S. Army missile to use ready-packaged and storable liquid propellents

Date	Event	Source
June 1967	Development start of nuclear missile	69
July 1971	DSARC III approves contracting for long-lead time items	4
June 1972	IOC of nuclear LANCE	69
July 1972	DSARC II for non-nuclear version approves completion of engineering development and limited production	4
April 1974	First launch	57
May 1975	DSARC review for acquisition of non-nuclear LANCE or for LANCE II (TGSM)	58, p. 14

MIM-23A/B HAWK AND I-HAWK (HOMING ALL THE WAY KILLER)

- Mobile day-and-night, all-weather surface-to-air missile designed to counter low- and medium-altitude supersonic aircraft
- 25-mile slant range; Mach 2.5 speed; 100-ft floor to 60,000 ft plus ceiling
- Continuous wave (CW) semi-active radar homing is used to guide missile
- The system has undergone constant evaluation to ensure continued effectiveness against the threat; the I-HAWK has a higher performance motor and an improved and smaller guidance package
- 23,453 Hawk systems were built through FY79 and the HAWK Improvement Program (HIP) consisted of 6,633 missiles and 98 General Support Equipment tests

Milestone	Date	Event	Source
	1953	Development begins on MIM-23A	10
	1957	Production initiated	10
	1959	IOC	10
B	November 1964	HAWK improvement program begun	59; 10
	June 1969	First production contract	59
	July 1970	DSARC III, I-HAWK	4
	August 1970	Second production buy	59
	December 1970	First production test missile delivery	59
C	November 1972	IOC for initial deployment	59; 10; 69

MIM-72A CHAPPAREL AND MIM-72C/F IMPROVED CHAPPAREL

- Supersonic air defense missile designed to counter low-flying aircraft and helicopters using passive infrared homing
- A version missiles identical to Navy Sidewinder; C version missiles featured new fuzing, better guidance, and a new warhead
- C version can engage from any angle and is less observable with smokeless rocket motor
- Can be deployed on self-propelled M54 guided missile launching station with four mounted missiles and eight reloads, or on towed trailers with four mounted missiles and four stowed reloads
- Improvements in Forward-Looking Infrared (FLIR) night sight performance and the addition of crew NBC protection, a dual mode seeker and an early warning display unit will keep system effective through 1990's
- Total requirement for 25,210 missiles and 632 fire units

Date	Event	Source
1964	Development begins	10
February 1965	RDT&E program initiated	10
1969	A version IOC	10
November 1974	Improved Chapparel type classified standard	10
July 1975	IFF effort begins	10
November 1975	Initiate smokeless motor effort	10
July 1977	First production MIM-72C delivered, less smokeless motor	10
March 1980	Smokeless motor approved for production	10

MIM-104 PATRIOT (SAM-D)

- o All-weather surface-to-air missile designed to defend high-value targets in rear areas against high performance aircraft at all altitudes
- o Can track up to 50 targets simultaneously and guide (Track Via Missile-TVM) five missiles in flight (Mach 2 to 3) to a range of 37 n mi and a height of 80,000 ft
- o Army plans to buy 105 fire units (64 missiles) carried on mobile semi-tractor trailer launchers (4 missiles, with 4 available for reload)

Milestone	Date	Event	Source
	1963	Army Air Defense System 1970 (AADS-70) starts	10
	August 1965	Program management handed over to MICOM	10
A	May 1967	Contract definition completed, advanced development contract to Raytheon	10; 60
B	February 1972	DSARC II, approved for engineering development	4
	March 1972	DepSecDef memorandum and FSD contract	60
	February 1975	Advanced development/fire control section (AD/FCS) guidance flight initiation	60
	1976	DoD decision to start FSED	10
	January 1976	Approve resumption of FSD	4
	December 1976	Engineering development (ED)/FCS system demonstration flight initiation	60
	June 1977	Initial firing series conducted against a drone	61, p. 47
	March 1980	DSARC decision to proceed with production	10
	September 1980	DSARC approves limited production	10
	October 1980	Limited production contract	10
C	February 1982	First production delivery	10
	May 1982	First battalion activation	10
	1 June 1982	First production units delivered to Army	10
	October 1982	Production Patriot downs QF-86	10
	April 1985	First battalion USAREUR IOC	10

PERSHING II

- o Two-stage surface-to-surface single-warhead tactical nuclear missile designed to counter the SS-20 by providing an accurate and devastating deterrent; 1,116 mile range
- o Pershing II implements several new technologies: Automatic Reference System (ARS) provides automatic missile firing azimuth alignment without reference to any pre-surveyed point; Sequential Launch Adapter (SLA) permits three Pershings to be launched from a single station without uncabling and recabling after each launch; radar area correlator guidance (RADAG) that matches radar pictures taken during reentry with stored radar pictures of the target area
- o Its vastly improved accuracy permits use a low yield warhead that, along with its deep penetration, limits collateral damage
- o 108 will be deployed in Europe

Milestone	Date	Event	Source
A	January 1974	DSARC I, approves initiation of validation phase	4
	November 1977	Start development Test I	10
B	December 1978	DSARC II meeting	4; 10
	February 1979	FSED contracts to Martin Marietta	10
	June 1982	Full-scale production contract	10
	July 1982	Start of integrated flight testing	10
C	October 1982	First production buy of two missiles	10
	November 1982	First successful launch	64
	April 1983	DSARC III	10
	September 1983	Complete engineering development	10
	December 1983	IOC	10
	February 1988	Production deliveries complete	10

RIM-116A
ROLLING AIRFRAME MISSILE (RAM) OR ANTI-SHIP MISSILE DEFENSE (ASMD)

- o Lightweight fire-and-forget shipboard missile for close-in defense against low-flying anti-ship missiles
- o Will increase total fire power of NATO Sea Sparrow launchers to provide better defense against saturation attacks
- o Uses passive dual-mode radio frequency/infrared guidance

Milestone	Date	Event	Source
A	February 1977	Advanced development contract	10
	April 1977	Flight test program of flight and test vehicles begins	10
B	February 1979	Navy DSARC engineering development decision	10
	May 1979	Memorandum of Understanding (MOU) signed for full-scale development	10
	June 1979	FSED contract to General Dynamics	10
	August 1979	Begin development prototype flight tests	10
	June 1980	Begin engineering model missile flight tests	10
	March 1982	DSARC IIB	10
	August 1985	General Dynamics awarded contract for Phase I transition production planning for special tooling and test equipment	10
	February 1986	Flight testing resumes	10
	July 1986	Successful flight test by General Dynamics	10
	FY 87	Both HASC and SASC recommend cancellation	10

RIM-66B STANDARD MISSILE-1 MEDIUM RANGE (MR)
RIM-66C STANDARD MISSILE-2 MEDIUM RANGE
RIM-67A STANDARD MISSILE-1 EXTENDED RANGE (ER)
RIM-67B STANDARD MISSILE-2 EXTENDED RANGE

- o Primary fleet surface-to-air missiles employed by Aegis, Tartar and Terrier weapon systems on guided missile cruisers, destroyers, and frigates for defense against aircraft, missiles, and ships; in service on 110 ships
- o Navy is developing SM-3 or ASAM (Advanced Surface-to-Air Missile) to be launched from the vertical launching system (VLS) for longer range defense than the SM-2 provides

Date	Event	Source
1967	SM-1 MR goes into production	10
December 1976	First at sea launch of SM-2 ER	10; 65, p. 22
December 1976	Initial at sea tests of SM-2 MR	10

SICBM MIDGETMAN

- o Small (30,000 lb, 44 ft), mobile, single warhead (500 kT) ICBM intended to provide more targeting flexibility and greater strategic stability
- o Will be carried in hardened truck launchers, referred to as Armadillos, deployed on DoD land in the Western U.S.
- o Will use either stellar inertial guidance or a modified version of the advanced inertial reference sphere (AIRS) INS
- o Current plans are for 500 missiles

Milestone	Date	Event	Source
	28 August 1981	Air Force Ballistic Missile Office issues a solicitation of contractor interest in the SICBM concept	10
	April 1983	President endorses SICBM concept after receiving commission on strategic forces report	10
	May 1983	AF BMO opens Small Missile Program Office	10
A	December 1983	System definition phase begins, concept definition contracts	10
	March 1985	Pre-FSD phase begins	10
B	December 1986	Joint Resources Management Board (JRMB) II approval; FSD start for single-warhead ICBM weighing no more than 37,000 lb and launched from a hardened mobile launcher (HML)	77

SM-64 NAVAHO

- Huge (300,000 lb, 95 ft), long-range strategic cruise missile that was cancelled in favor of ballistic missiles
- It was launched by three liquid-propellent rocket engines, each with 135,000 lb of thrust and flown by a ramjet engine at Mach 3; used all inertial guidance
- Although cancelled, its technologies were widely applied to subsequent systems: rocket engines to Jupiter, Thor, and Atlas and to Redstone engine; high-speed flight aided Hound Dog and Minuteman; all inertial guidance was used on Hound Dog, Minuteman, XB-70, Vigilante bomber, and the Navy's long submerging nuclear submarines

Milestone	Date	Event	Source
A	April 1946	Navaho research and development program begins as a one year study and research effort by North American Aviation	1
	1947	Original program expands to develop three missile designs with gradually increasing ranges	1
	26 May 1948	First Navaho research test vehicle (NATIV) successfully launched at White Sands Proving Ground, New Mexico	6
	Late 1949	AF decides to develop the intermediate range vehicle with 1,000 n mi range into an air-launched weapon	1
	February 1950	Three phases outlined	1
	July 1950	AF drops plans for the air-launched missile in favor of supersonic, intercontinental guided missile	1
	September 1950	New program aimed at a surface-launched 5,500 mile missile by 1958 proposed by North American and accepted by the AF	1
B	March 1952	AF contracts for two XB-64 vehicles to be delivered in January and May 1954	1
	May 1952	$4 million budget cut in FY1953 budget; schedule slippage pushes acceptance date to May 1954	1
		XB-64A program delay also. Delivery of first missile rescheduled for June 1957 with first flight for December 1957	1
	October 1953	AF decides to increase the size of the XB-64A rather than depend on super fuels to increase the range	1
	Early 1955	B symbol eliminated, replaced by SM	1

Milestone	Date	Event	Source
	June 1955	Formal mock-up inspection	1
	23 February 1956	AF Secretary Donald A. Quarles directs the acceleration of the Navaho missile program	6
	August 1956	Three unsuccessful attempts at static firing of the rocket booster for XSM-64	1
	6 November 1956	First XSM-64 firing and flight unsuccessful; flight lasts only 26 sec	1
	22 March 1957	Second launch of XSM-64 missile; considered a partial success	1
	25 April 1957	Third attempt to launch XSM-64 fails	1
	12 July 1957	Navaho program canceled	6
	September 1957	First successful launch	41, p. 43

SM-75 THOR

- o Liquid fuel propellent IRBM stationed in Europe intended as a maximum risk program with objective of demonstrating ballistic missile flight potential at the earliest possible date

Milestone	Date	Event	Source
	November 1955	SecDef approves program, assigns it to WDD	43; 41, p. 84
B	December 1955	President approves; WDD selects Douglas	2, p. 7-1; 43
	January 1957	Missile tested on launch pad, unsuccessful	2, p. 7-1; 4
	April 1957	Second launch, partially successful	43
	September 1957	First successful flight, fifth flight test	41, p. 92; 4
	December 1957	Go-ahead production decision, direction to proceed with 4 squadrons each of Thor and Jupiter IRBM's	2, p. 7-1; 4
C	May 1958	Air Force accepts the first operational Thor IRBM	43
	August 1958	Last of the 18 Thor R&D test missiles launched	43
	October 1958	Procurement of first four squadrons of operational Thors formally authorized	41, p. 92
	December 1958	Thor launched from operational training site by SAC crew, transition into initial military readiness	2, p. 7-1; 42, p. 151
	April 1959	First Thor launched by RAF crew	43
	December 1959	British Air Ministry announces operational status achieved	43

SM-68 TITAN I

- ò Two-stage, liquid propellent missile developed as a back-up program in case of Atlas failure
- o As second U.S. ICBM, it incorporated advanced features that required more development time than the stringent Atlas schedule permitted
- o Used monocoque airframe, advanced radio-guided control system, and launch from hardened silos

Milestone	Date	Event	Source
	January 1955	General Shriever proposes that an alternate two-stage configured ICBM be developed as a competitor and back-up to Atlas	43
A	May 1955	HQ USAF directs ARDC to proceed with an alternate ICBM designated Titan I	2, p. 7-6; 4
	September 1955	Contract to build missile awarded	2, p. 7-6
B	October 1955	Martin Company receives letter contract to design, develop, and test the Titan	2, p. 7-6; 4
	February 1959	First launch, with dummy first stage, successful	41, p. 92; 43
	August 1959	First full-powered launch attempt fails	43
	February 1960	First operational prototype successfully launched long-range (4,535 n mi)	2, p. 7-5; 43; 41, p. 92
C	August 1960	First successful flight and launch of operational Titan I	43

TM-61A MATADOR

- o First pilotless tactical weapon built by Air Force; first such weapon deployed in Europe; and first aircraft or missile built in sections and assembled in the field
- o 34-ft length, 21-ft wing span, 14,500-lb weight
- o Launched by solid booster and flown by turbojet at 650 mph for a range of 500 to 600 miles (35,000 ft ceiling)
- o Various modifications ultimately led to the Mace missile

Milestone	Date	Event	Source
A	24 August 1945	AAF military characteristics published for development of a ground-launched pilotless bomber with a 175-500 mile range and a 600 mph speed	1
	Mid-December 1945	Glenn L. Martin Co. submitted a development proposal	1
	March 1946	Letter contract for $864,000 for a one year research agenda awarded to Martin for a subsonic and supersonic 175-500 mile range guided missile	1
	October 1946	Further contract awarded Martin to continue research	1
	December 1946	Because of a reduction in AAF R&D funds, Martin was requested to continue research on subsonic missile only	1
B	30 June 1947	Materiel Command contracted for production of one missile	1
	10 December 1947	First dummy missile launched	1
	May 1948	AF contracted for 14 experimental (XSSM-A-1) missiles	1
	June 1948	Contract signed	1
	19 January 1949	First experimental missile launched	1
	January 1949-December 1950	15 experimental missiles launched	1
	September 1950	AF gives Matador 1-A priority	1
	September 1950	First experimental missile delivered	1
	21 December 1950	Letter contract calls for production line to be set up	1
	22 December 1950	Second letter contract provides for 70 missiles	1

Milestone	Date	Event	Source
	7 December 1951	First experimental Matador launched by military personnel	1
	24 March 1952	New contract raises number of TM-61A missiles to 255	1
C	June 1952	First production Matador delivered	1
	December 1952	First successful flight of a TM-61A	1
	November 1954	Martin authorized to procure materials and begin necessary engineering work for the TM-61C production program	1

TM-76B MACE

- o 1000-mile-range tactical surface-to-surface guided nuclear missile
- o Uses inertial guidance rather than the more vulnerable ATRAN terrain-matching radar guidance used on the A version
- o 1,050 km/hr speed

Milestone	Date	Event	Source
A	12 October 1954	GOR 37 issued	1
	19 January 1955	System requirement No. 15	1
	Late 1955	Funds allocated and contract let to Martin	1
B	27 January 1956	Development contract	1
	1956	Active R&D	1
	1957	Funds severely cut	1
	7 August 1959	Production contract	1
	6 February 1958	First inertial guidance flight	1
C	November 1960	First production delivery	1

UGM-27A/B/C A-1, A-2 and A-3 POLARIS

- o Solid-fueled submarine launched ballistic missile (SLBM) with range of 1,200 n mi for A-1, 1,500 n mi for A-2 and 2,500 n mi for A-3
- o The A-1 was the accelerated version deployed in 1960. The A-2 was the original missile design
- o A-1 deployed on the first five Polaris subs (SSBN 602), all 41 Polaris subs eventually upgraded to A-2 or A-3

Milestone	Date	Event	Source
	July 1955	Admiral Russell, Chief of the Bureau of Aeronautics, proceeds with development of ballistic missile (soon known as Fleet Ballistic Missile, FBM) to be ready in five to seven years, requests technical proposals from twenty companies	70, p. 19
	September 1955	Adm Arleigh Burke, CNO, decides to pursue both a ballistic missile and a cruise missile capability	70, p. 21
	September 1955	President and DoD decide to pursue only four ballistic missile programs (Atlas, Titan, Thor, and Jupiter) leaving the Navy to find a partner	70, p. 21
	8 November 1955	SecDef establishes joint Army-Navy IRBM program for liquid-fueled missile	70, p. 23
	17 November 1955	Special Projects Office established to manage Navy's portion of the Joint Army-Navy Jupiter Program, headed by Adm Raborn	70, p. 8
	January 1956	Navy approaches Aerojet-General and Lockheed for technical assistance in developing solid-fueled missile	70, p. 26
	March 1956	The Office of the Secretary of Defense Ballistic Missile Committee (OSDBMC) approves "backup program" for solid-fuel IRBM as successor to Jupiter (Jupiter S)	70, p. 25
	June-September 1956	NOBSKA Summer Study of National Academy of Sciences sponsored by the CNO recommends solid-fueled ballistic missile with weight of eight to fifteen tons, range of 1,000 to 1,500 miles and a low-yield warhead	70, p. 31; 74, p. 309
	September 1956	Atomic Energy Commission confirms possibility of developing 600-lb warhead with same yield as Jupiter's 1,600-lb warhead	70, p. 32; 74, p. 309
	8 December 1956	Navy receives permission to terminate participation in joint Jupiter program and begin Polaris FBM development	70, p. 33-34; 74, p. 309; 42, p. 166

Milestone	Date	Event	Source
	March 1957	Missile envelope and method of launching fixed by the Steering Task Group	42, p. 170
	17 June 1957	Adm Burke approves ship characteristics	74, p. 310
	18 November 1957	President approves acceleration of program, three Polaris subs in 1958 supplemental program, two in the 1959 program	74, p. 314
	23 March 1958	"Pop-up" submerged launch technique demonstrated	42, p. 170
	24 September 1958	17 AX flight tests begin	71, p. 106 42, p. 173
	20 April 1959	AX-6 is the first successful launch	42, p. 173
	9 June 1959	USS *George Washington* launched	42, p. 168
	15 July 1959	First guided flight, AX-11	42, p. 173
	14 August 1959	AX-13 launched from tube at Canaveral	42, p. 174
	21 September 1959	First flight tests of pre-prototype tactical version, A1X; 30 flight tests	71, p. 106
	20 July 1960	First A-1 test firing from a submerged sub; USS *George Washington* launches the 31st A-1 missile off Cape Canaveral	70, p. 9; 42, p. 162
	November 1960	Development test firing of A-2 begins	71, p. 106
C	15 November 1960	Polaris subs go on alert	75, p. 327
	23 October 1961	First successful submerged launch of A-2	71, p. 106
	26 October 1963	First at-sea tube launch of A-3	71, p. 106
	September 1964	A-3 enters operational service	71, p. 106
	14 October 1965	Last Polaris A-1 retired	71, p. 104

UGM-73A C-3 POSEIDEN

- o Follow-on to Polaris with 2,800 n mi range and up to 10 MIRVs in its enlarged Mk-3 warhead
- o Installed on 31 *Lafayette* class subs in 16 tubes for a total of 496 missiles

Milestone	Date	Event	Source
A	November 1963	Special Projects Office authorized to proceed with definition of Polaris follow-on, initially designated B-3, that would enhance FBM penetration of defended urban-industrial targets	70, p. 220
	November 1964	Special Projects Office directed to include the MIRV concept and advanced guidance systems in its B-3 designs, giving the new design a hard and soft target capability	70, p. 220
B	January 1965	Missile redesignated Poseiden C-3 from Polaris B-3 and development approved by President	70, p. 220; 72
	16 August 1968	First flight model launched	71, p. 108
	April 1969	USS *James Madison* enters shipyard for conversion to Poseiden configuration	71, p. 108
	December 1969	First complete missile test	73
	June 1970	Flight tests complete, 14 of 20 successful	73
	3 August 1970	First submerged launch	73
C	31 March 1971	First operational delivery, USS *James Madison* deployed on patrol from Charleston, South Carolina	73
	January 1976	Last production missile accepted	72
	January 1978	Modification retrofit completed	72

UGM-96A C-4 TRIDENT I

- o Long-range strategic submarine-launched ICBM to replace Poseiden
- o Same accuracy (1,500 ft CEP) and effectiveness as Poseiden (10, 100 kT warheads) but with twice the range (4,800 to 6,000 n mi)
- o Inventory objective of 570 missiles

Milestone	Date	Event	Source
A	October 1971	Program planning phase	10
	December 1971	Development contract award	10
B	October 1973	DSARC II, approve missile	4; 69
	March 1974	Technical program approval	10
	August 1976	Engineering development testing begins	10
	December 1976	DSARC III, approve production	4; 10
	September 1978	Navy begins retrofit of the first 12 Poseiden submarines with Trident missiles	72
C	October 1979	Operational Availability Date (OAD), missile deployed, IOC	10; 69
	January 1982	USS *Ohio* launches first Trident I	10

TRIDENT II D-4

- o First SLBM to give Navy hard target kill capability (400 ft CEP) by using the Mk 5 reentry vehicle (the Navy's version of the MX reentry vehicle) that carries 10 to 15 300-475 kT warheads
- o With diameter of 83 inches and height of 44 feet it uses the full capacity of the Trident submarine missile tubes
- o Current plan for 16 Trident submarines with 764 Trident II missiles

Milestone	Date	Event	Source
	October 1977	Start of concept formulation effort	10
A	October 1980	Advanced development begins	10
	February 1981	JMSNS	4
B	September 1983	DSARC II, FSD approved	10; 4
	October 1983	FSED begins, contract issued to Lockheed	10
	January 1987	Scheduled flight tests	10
	March 1987	DSARC III	4; 10

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